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(54) Title: HEAT-SHRINKABLE FILM (57) Abstract A heat shrinkable film suitable for use in cook-in applications is provided which exhibits a transverse direction free shrink at 50 °C of less than about 2 % and a transverse direction free shrink at 57 °C of at least about 3 %. The film has at least two layers. The first layer includes an ethylene/vinyl alcohol copolymer and the film has a second layer directly adhered to the first layer, the second layer including at least one member selected from the group consisting of polyester, polyamide and polyurethane. Preferably, the desired shrink properties are attained by annealing the film under controlled conditions.		

HEAT-SHRINKABLE FILM

BACKGROUND INFORMATION

5 1. Field of the Invention

The present invention relates generally to heat-shrinkable films suitable for cook-in applications. The present invention is also directed to articles of manufacture which are useful for packaging various products. The present invention is particularly related to a process for packaging a meat product in a heat-shrinkable film.

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2. Background of the Invention

Many food products are processed in thermoplastic film packages by subjecting the packaged product to elevated temperatures produced by, for example, immersion in hot water or exposure to steam. Such thermal processing often is referred to as cook-in, and films used in such processes are known as cook-in films.

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A food product that is packaged and processed in this manner can be refrigerated, shipped, and stored until the food product is to be consumed or further processed by, for example, slicing and repackaging into smaller portions for retail display. Alternatively, the processed food can be removed immediately from the cook-in package for consumption or further processing (e.g., sliced and repackaged).

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A cook-in film must be capable of withstanding exposure to rather severe temperature conditions for extended periods of time while not compromising its ability to contain the food product. Cook-in processes typically involve a long cook cycle. Submersion in hot (i.e., about 55°C to 65°C) water for up to about 4 hours is common; submersion in 70° to 100°C water or exposure to steam for up to 12 hours is not uncommon, although most cook-in procedures normally do not involve temperatures in excess of about 90°C.

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It is important that a cook-in film have good inter-ply adhesion and not experience delamination either before, during or after the cooking process. If the inter-ply bond strength of the cook-in film is weak, the cooking process could exacerbate the weak bond strength and cause delamination in the film. Furthermore, if the film has weak inter-ply

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bond strength, the process of stripping the film from the cooked food product could result in the film delaminating at the weakest link, thereby leaving behind residual film on the cooked product. This is hazardous from a health perspective as cook-in films are often clear, and the customer could inadvertently consume plastic along with the food-product.

5 Following the cook-in process, the film or package preferably conforms, if not completely then at least substantially, to the shape of the contained food product. Often, this is achieved by allowing the film to heat shrink under cook-in conditions so as to form a tightly fitting package. Alternatively, the cook-in film package can be caused to shrink around the contained food product prior to initiating the cook-in procedure by, for
10 example, placing the package in a heated environment prior to cooking. Also, during cook-in the film should preferably have food product adherence to restrict "cook-out," i.e., the collection of juices between the surface of the contained food product and the food-contact surface of the packaging material. In this manner, product yield is increased by the food product retaining moisture.

15 Various meat products, such as pork, sausage, poultry, mortadella, bologna, beef, braunsweiger, etc. are prepared as cook-in products. Other non-meat products such as soybean also are considered to be proteinaceous. In all the above cases, it is important for the film to possess good inter-ply bond strength and also important to obtain adequate film-to-food adhesion and provide a snug package for superior aesthetic appearance.

20 For cook-in applications, packaging materials typically are produced in roll form and then converted into shirred sticks, bags, pouches, etc., for the end user. In the past, heat-shrinkable packaging films which have been provided to the cook-in end-user undesirably have been characterized by inconsistent widths. This inconsistency arises because of two primary reasons. First, heat-shrinkable films have significant free shrink at
25 temperatures as low as 50°C, in some cases 45°C, and in some cases, as low as 40°C. Thus, upon exposure to environments where the temperature exceeds 40°C and sometimes 45°C, the heat-shrinkable film partially shrinks, causing a change in its width. Obviously, this is more of a problem during storage or transportation of heat-shrinkable films in the hotter summer months. Second, heat-shrinkable films are produced in roll-form. When
30 films are wound into rolls, the leading edge of the film being rolled typically experiences higher tension than the outer portions of the roll. Since polymers are viscoelastic in

nature, the film material at the outer portions of a roll (which is under little/no tension) tends to 'snap back' like a rubber band, relaxing some of the strain imparted by the orientation process. However, film material at the inner portion of the roll is under tension and therefore unable to relax or snap back. This can result in film which is the first used
5 from the roll, i.e., the outer portions of the roll, having a significantly lower width than film at the interior of the roll. Consequently, heat-shrinkable films can vary in width as much as 5%, and in extreme situations, as much as 7% or 10%.

The marketplace continues to express a need for films which are more consistent in width and are dimensionally stable when exposed to temperatures of 40°C, 43°C, 47°C or
10 even 50°C. This demand arises from the need to stuff the same quantity of meat product into each casing length, especially where the film is formed into shirred casings. In such cases, the width of the packaging material preferably varies less than 3%, more preferably, less than 2%. Packages produced from shirred casings often are cooked in molds, with the cooked meat-product then being sliced. An inconsistent film width will result in an
15 inconsistent package size and, therefore, in significantly greater yield loss.

To provide end-user with film that is more consistent in width, it is advantageous to anneal the heat-shrinkable cook-in films. Typically, a moving web of film is heated to an elevated temperature in a continuous process. Upon heating the film to an elevated temperature (typically as high as 60°C), the film shrinks and reduces in width. As a result
20 of this shrinking, the film has now lost some or all of its ability to shrink at or near that elevated temperature. If the process of heat-treatment at an elevated temperature is conducted with a moving web, rather than a roll of film, the process also reduces or eliminates width variation in the film due to the viscoelastic nature of the film (as described above). Thus, the process of annealing produces a film with a more consistent
25 width.

However, the process of annealing as described above can produce certain disadvantages. For example, the annealing process can exacerbate weak inter-ply bond strength in a film. In other words, annealed films can exhibit inter-ply bond strength significantly inferior to that of non-annealed films having the same or similar composition
30 . Often this is characterized by a significantly increased level of tubing striations, wrinkles and creases (i.e., the annealed tubing can have an appearance which is significantly worse

than the precursor, unannealed tubing). It is believed that these defects occur in tubing with inherent weak inter-ply bond strength due to differential shrinking of adjacent film layers.

5 Additionally, cooked packages produced from some annealed films can be relatively flaccid because the film does not fit snugly around the packaged product, creating an unsightly package which includes cook-out from the underlying food product. Such cook-out is evidenced even when the heat-shrinkable film includes a food-contact surface which would be expected to provide adequate film-to-meat adhesion to prevent substantial purge or cook-out.

10 Thus, providing a film which exhibits good width stability during transportation and storage in hot environments, yet remains suitable for cook-in applications which require good inter-ply bond strength and adequate adhesion remains desirable. Such a film also preferably would have the ability to conform to the food product during cooking and after the cook-in process to prevent substantial purge loss/cook-out, thereby providing a
15 tight, more aesthetically pleasing package.

SUMMARY OF THE INVENTION

Briefly, the present invention is directed to a heat-shrinkable film suitable for cook-in applications which includes a first layer of an ethylene/vinyl alcohol copolymer, and a
20 second layer directly adhered to the first layer of polyester, polyamide or polyurethane, wherein the film has a transverse direction free shrink at 57°C of at least 3% and a transverse direction free shrink at 50°C of less than about 2%.

In a second aspect, the present invention is directed to a heat-shrinkable film suitable for cook-in applications which includes a first layer of an ethylene/vinyl alcohol
25 copolymer, and a second layer directly adhered to the first layer of polyester, polyamide or polyurethane, wherein the film has been heated to an elevated temperature to dimensionally stabilize it; and wherein the film has a transverse direction free shrink at 57°C of at least about 3%.

In a third aspect, the present invention is direct to a process for making a heat
30 shrinkable film suitable for use in cook-in applications which includes the steps of coextruding at least a first layer of ethylene/vinyl alcohol and a second layer of polyester,

polyamide or polyurethane, wherein the second layer is immediately adjacent to the first layer, cooling the extruded layers, thereby forming a preliminary tape, orienting the tape at an orientation temperature of at least 60°C and no greater than 140°C, thereby forming a preliminary heat shrinkable film material, allowing the preliminary heat shrinkable film material to cool, and heating the preliminary heat shrinkable film material to an elevated temperature of at least about 35°C and no greater than 100°C, thereby providing a heat shrinkable film having a transverse direction free shrink at 57°C of at least about 3% and a transverse direction free shrink at 50°C of less than about 2%.

To assist in understanding the more detailed description of the invention that follows, certain definitions are provided immediately below. These definitions apply herein throughout unless a contrary intention is explicitly indicated:

As used herein, the phrase "free shrink" refers to the percent dimensional change in a 10 cm x 10 cm specimen of film, when subjected to selected heat (i.e., at a certain temperature), with the quantitative determination being carried out according to ASTM D 2732, as set forth in the 1990 Annual Book of ASTM Standards, Vol. 08.02, pp.368-371, which is hereby incorporated, in its entirety, by reference thereto.

As used herein, the term "film" is used in a generic sense to include plastic web, regardless of whether it is film or sheet. Preferably, films of and used in the present invention have a thickness of 0.25 mm or less. As used herein, the term "package" refers to packaging materials used in the packaging of a product.

As used herein, the phrases "seal layer", "sealing layer", "heat seal layer", and "sealant layer", refer to an outer layer, or layers, involved in the sealing of the film to itself, another layer of the same or another film, and/or another article which is not a film. Although it should also be recognized that in general, up to the outer 3 mils of a film can be involved in the sealing of the film to itself or another layer, the phrase "seal layer," and the like, refer herein only to the outer layer(s) which is to be heat-sealed to itself, another film, etc. Any inner layers which contribute to the sealing performance of the film are herein designated as "seal-assist" layers. With respect to packages having only fin-type seals, as opposed to lap-type seals, the phrase "sealant layer" generally refers to the inside layer of a package, the inside layer being an outer layer which frequently also serves as a food contact layer in the packaging of foods. However, in a multilayer film, the

composition of the other layers (within 3 mils of the inside surface) can also affect sealability and seal strength.

As used herein, the term "heat-seal," and the phrase "heat-sealing," refer to any seal of a first region of a film surface to a second region of a film surface, wherein the seal is formed by heating the regions to at least their respective seal initiation temperatures. The heating can be performed by any one or more of a wide variety of manners, such as using a heated bar, hot wire, hot air, infrared radiation, ultrasonic sealing, etc. Heat-sealing is the process of joining two or more thermoplastic films or sheets by heating areas in contact with each other to the temperature at which fusion occurs, usually aided by pressure.

Heat-sealing is inclusive of thermal sealing, melt-bead sealing, impulse sealing, dielectric sealing, and ultrasonic sealing.

As used herein, the term "barrier," and the phrase "barrier layer," as applied to films and/or layers, is used with reference to the ability of a film or layer to serve as a barrier to one or more gases. In the packaging art, oxygen (i.e., gaseous O₂) barrier layers have, in general, included, for example, ethylene/vinyl alcohol copolymer, polyvinylidene chloride (PVDC), polyalkylene carbonate, polyamide, polyethylene naphthalate, polyester, polyacrylonitrile, etc., as known to those of skill in the art.

As used herein, the phrases "abuse layer", as well as the phrase "puncture-resistant layer", refer to any layer which serves to resist abrasion, puncture, and other potential causes of reduction of package integrity, as well as potential causes of reduction of package appearance quality. As used herein, the phrase "skin layer" refers to an outside layer of a multilayer film in packaging a product, this skin layer being subject to abuse.

As used herein, the term "core", and the phrase "core layer", as applied to multilayer films, refer to any internal layer which preferably has a function other than serving as an adhesive or compatibilizer for adhering two layers to one another. Usually, the core layer or layers provide the multilayer film with a desired level of strength, i.e., modulus, and/or optics, and/or added abuse resistance, and/or specific impermeability.

As used herein, the phrase "tie layer" refers to any internal layer having the primary purpose of adhering two layers to one another. In one preferred embodiment, tie layers can comprise any polymer having a polar group grafted thereon, so that the polymer is capable of bonding to polar polymers such as polyamide and ethylene/vinyl alcohol copolymer.

Preferred polymers for use in tie layers include, but are not restricted to, ethylene/unsaturated acid copolymer, ethylene/unsaturated ester copolymer, anhydride-grafted polyolefin, polyurethane, and mixtures thereof.

As used herein, the phrase "bulk layer" refers to any layer of a film which is present for the purpose of increasing the abuse-resistance, toughness, modulus, etc., of a multilayer film. Bulk layers generally comprise polymers which are inexpensive relative to other polymers in the film.

As used herein, the phrases "food-contact layer" and "meat-contact layer", refer to a layer of a multilayer film which is in direct contact with the food/meat in the package comprising the film. The food-contact/meat-contact layer is an outer layer of the multilayer film, in the sense that the food-contact/meat-contact layer is in direct contact with the meat product within the package. The food-contact/meat-contact layer is an inside layer in the sense that with respect to the packaged food product/meat product, the food-contact/meat-contact layer is the inside layer (i.e., innermost layer) of the package, this inside layer being in direct contact with the food/meat.

As used herein, the phrase "food-contact surface" and "meat-contact surface" refers to an outer surface of a food-contact layer/meat-contact layer, this outer surface being in direct contact with the food/meat within the package.

As used herein, the phrase "thickness uniformity" refers to percent value obtained by measuring the maximum and minimum thickness of the film and applying these numbers to the following formula:

$$\text{Thickness Uniformity (\%)} = \frac{\text{film thickness}_{(\text{min})}}{\text{film thickness}_{(\text{max})}} \times 100.$$

The maximum and minimum thicknesses are determined by taking a total of 10 thickness measurements at regular distance intervals along the entirety of the transverse direction of a film sample, recording the highest and lowest thickness values as the maximum and minimum thickness values, respectively, and computing the thickness uniformity (a percent value) using the formula above. A thickness uniformity of 100% represents a film of absolute thickness uniformity, i.e., no measurable differences in thickness; in contrast, a

film in which the film thickness(min) is measured at 45% of the film thickness(max) has a thickness uniformity of only 45%.

As used herein, "EVOH" refers to ethylene/vinyl alcohol copolymer, i.e., polymerized ethylene vinyl alcohol. EVOH includes saponified or hydrolyzed ethylene/vinyl acetate copolymers, and refers to a vinyl alcohol copolymer having an ethylene comonomer, and prepared by, for example, hydrolysis of vinyl acetate copolymers, or by chemical reactions with polyvinyl alcohol. The degree of hydrolysis is preferably at least 50%, and more preferably, at least 85%. Preferably, the EVOH comprises from about 28 to about 48 mole % ethylene, more preferably, from about 32 to about 44 mole % ethylene, and even more preferably, from about 38 to about 44 mole % ethylene.

As used herein, the term "lamination", the term "laminated", and the phrase "laminated film", refer to the process, and resulting product, made by bonding together two or more layers of film or other materials. Lamination can be accomplished by joining layers with adhesives, joining with heat and pressure, and even spread coating and extrusion coating. The term laminate is also inclusive of coextruded multilayer films comprising one or more tie layers. as a verb, "laminated" means to affix or adhere (by means of, for example, adhesive bonding, pressure bonding, corona lamination, and the like) two or more separately made film articles to one another so as to form a multilayer structure; as a noun, "laminated" means a product produced by the affixing or adhering just described.

As used herein, the term "oriented" refers to a polymer-containing film which has been stretched at an elevated temperature (the orientation temperature), followed by being "set" in the stretched configuration by cooling the material therefore retaining the stretched dimensions. Upon subsequently heating unrestrained, unannealed, oriented polymer-containing material to its orientation temperature, heat shrinkage is produced almost to the original unstretched, i.e., pre-oriented dimensions. As used herein, "oriented" films are stretched in the solid state as contrasted to blown films which are stretched in the melt state. More particularly, the term "oriented", as used herein, refers to oriented films and articles fabricated from oriented films, wherein the orientation can be produced in one or more of a variety of manners.

As used herein, the phrase "orientation ratio" refers to the multiplication product of the extent to which the plastic film material is expanded in several directions, usually two directions perpendicular to one another. Expansion in the machine direction is herein referred to as "drawing", whereas expansion in the transverse direction is herein referred to as "stretching". For films extruded through an annular die, stretching is usually obtained by cooling the extrudate to a solid state and (below the crystallization temperature), reheating the film to its softening temperature, and then introducing compressed air between two nip rolls to produce a standing trapped bubble. For such films, drawing is usually obtained by passing the film through two sets of powered nip rolls, with the downstream set having a higher surface speed than the upstream set, with the resulting draw ratio being the surface speed of the downstream set of nip rolls divided by the surface speed of the upstream set of nip rolls. The degree of orientation is also referred to as the orientation ratio, or sometimes as the "racking ratio". The degree of orientation in the longitudinal direction is often referred to as longitudinal racking ratio (LRR) while the degree of orientation in the transverse direction is often referred to as transverse racking ratio (TRR).

As used herein, the phrase "machine direction", herein abbreviated "MD", or "longitudinal direction", refers to a direction "along the length" of the film, i.e., in the direction of the film as the film is formed during extrusion and/or coating.

As used herein, the phrase "transverse direction", herein abbreviated "TD", refers to a direction across the film, perpendicular to the machine or longitudinal direction.

As used herein, the phrases "heat-shrinkable," "heat-shrink," and the like, refer to the tendency of a film, preferably an oriented film, to shrink upon the application of heat, i.e., to contract upon being heated, such that the size (area) of the film decreases while the film is in an unrestrained state. Likewise, the tension of a heat-shrinkable film increases upon the application of heat if the film is restrained from shrinking. As a corollary, the phrase "heat-contracted" refers to a heat-shrinkable film, or a portion thereof, which has been exposed to heat such that the film or portion thereof is in a heat-shrunken state, i.e., reduced in size (unrestrained) or under increased tension (restrained). The multilayer films of the invention can be annealed or heat-set to reduce the free shrink either slightly or substantially.

As used herein, the term "monomer" refers to a relatively simple compound, usually containing carbon and of low molecular weight, which can react to form a polymer by combining with itself or with other similar molecules or compounds.

As used herein, the term "comonomer" refers to a monomer which is
5 copolymerized with at least one different monomer in a copolymerization reaction, the result of which is a copolymer.

As used herein, the term "polymer" refers to the product of a polymerization reaction, and is inclusive of homopolymers, copolymers, terpolymers, etc. In general, the layers of a film can consist of a single polymer (with or without non-polymeric additives),
10 or can have still additional polymers together therewith, i.e., blended therewith.

As used herein, the term "mer" means that portion of a polymer derived from a single reactant molecule; for example, a mer unit from ethylene has the general formula —
 CH_2CH_2 —;

As used herein, the term "homopolymer" is used with reference to a polymer
15 resulting from the polymerization of a single monomer, i.e., a polymer consisting essentially of a single type of mer, i.e., repeating unit.

As used herein, the term "copolymer" refers to polymers formed by the polymerization reaction of at least two different monomers. For example, the term "copolymer" includes the copolymerization reaction product of ethylene and an alpha-
20 olefin, such as 1-hexene. However, the term "copolymer" is also inclusive of, for example, the copolymerization of a mixture of ethylene, propylene, 1-hexene, and 1-octene. The term copolymer is also inclusive of polymers produced by reaction, such as graft copolymer, block copolymer, and random copolymer.

As used herein, the term "interpolymer" means a polymer that includes mer units
25 derived from at least two reactants (normally monomers) and is inclusive of copolymers, terpolymers, tetrapolymers, and the like;

As used herein, the term "polymerization" is inclusive of homopolymerizations, copolymerizations, terpolymerizations, etc., and includes all types of copolymerizations such as random, graft, block, etc. In general, the polymers in the films used in accordance
30 with the present invention, can be prepared in accordance with any suitable polymerization

process, including slurry polymerization, gas phase polymerization, solution polymerization and high pressure polymerization processes.

As used herein, the term "copolymerization" refers to the simultaneous polymerization of two or more monomers to result in a copolymer. As used herein, a
5 copolymer identified in terms of a plurality of monomers, e.g., "propylene/ethylene copolymer", refers to a copolymer in which either monomer may copolymerize in a higher weight or molar percent than the other monomer or monomers. However, the first listed monomer preferably polymerizes in a higher weight percent than the second listed monomer, and, for copolymers which are terpolymers, tetrapolymers, etc., preferably the
10 first monomer copolymerizes in a higher weight percent than the second monomer, and the second monomer copolymerizes in a higher weight percent than the third monomer, etc.

For addition polymers, copolymers are identified, i.e., named, in terms of the monomers from which the copolymers are produced. For example, the phrase "propylene/ethylene copolymer" refers to a copolymer produced by the copolymerization
15 of both propylene and ethylene, with or without additional comonomer(s). A copolymer comprises recurring "mers" derived from the monomers from which the copolymer is produced, e.g., a propylene/ethylene copolymer comprises propylene mer units and ethylene mer units.

As used herein, terminology employing a "/" with respect to the chemical identity
20 of a copolymer (e.g., "an ethylene/alpha-olefin copolymer"), identifies the comonomers which are copolymerized to produce the copolymer. As used herein, "ethylene alpha-olefin copolymer" is the equivalent of "ethylene/alpha-olefin copolymer."

As used herein, the phrase "heterogeneous polymer" refers to polymerization reaction products of relatively wide variation in molecular weight and relatively wide
25 variation in composition distribution, i.e., typical polymers prepared, for example, using conventional Ziegler-Natta catalysts. Heterogeneous polymers are useful in various layers of the film used in the present invention. Although there are a few exceptions (such as TAFMER[™] linear homogeneous ethylene/alpha-olefin copolymers produced by Mitsui Petrochemical Corporation, using Ziegler-Natta catalysts), heterogeneous polymers
30 typically contain a relatively wide variety of chain lengths and comonomer percentages.

As used herein, the phrase "homogeneous polymer" refers to polymerization reaction products of relatively narrow molecular weight distribution and relatively narrow composition distribution. Homogeneous polymers are useful in various layers of the multilayer film used in the present invention. Homogeneous polymers are structurally different from heterogeneous polymers, in that homogeneous polymers exhibit a relatively even sequencing of comonomers within a chain, a mirroring of sequence distribution in all chains, and a similarity of length of all chains, i.e., a narrower molecular weight distribution. Furthermore, homogeneous polymers are typically prepared using metallocene, or other single-site type catalysts, rather than using Ziegler Natta catalysts.

More particularly, homogeneous ethylene/alpha-olefin copolymers may be characterized by one or more methods known to those of skill in the art, such as molecular weight distribution (M_w/M_n), composition distribution breadth index (CDBI), and narrow melting point range and single melt point behavior. The molecular weight distribution (M_w/M_n), also known as polydispersity, may be determined by gel permeation chromatography. The homogeneous ethylene/alpha-olefin copolymers useful in this invention generally have (M_w/M_n) of less than 2.7; preferably from about 1.9 to about 2.5; more preferably, from about 1.9 to about 2.3. The composition distribution breadth index (CDBI) of such homogeneous ethylene/alpha-olefin copolymers will generally be greater than about 70 percent. The CDBI is defined as the weight percent of the copolymer molecules having a comonomer content within 50 percent (i.e., plus or minus 50%) of the median total molar comonomer content. The CDBI of linear polyethylene, which does not contain a comonomer, is defined to be 100%. The Composition Distribution Breadth Index (CDBI) is determined via the technique of Temperature Rising Elution Fractionation (TREF). CDBI determination clearly distinguishes the homogeneous copolymers used in the present invention (narrow composition distribution as assessed by CDBI values generally above 70%) from VLDPEs available commercially which generally have a broad composition distribution as assessed by CDBI values generally less than 55%. The CDBI of a copolymer is readily calculated from data obtained from techniques known in the art, such as, for example, temperature rising elution fractionation as described, for example, in Wild et. al., *J. Poly. Sci. Poly. Phys. Ed.*, Vol. 20, p.441 (1982). Preferably, the homogeneous ethylene/alpha-olefin copolymers have a CDBI greater than about 70%, i.e.,

a CDBI of from about 70% to about 99%. In general, the homogeneous ethylene/alpha-olefin copolymers in the multilayer films of the present invention also exhibit a relatively narrow melting point range, in comparison with "heterogeneous copolymers", i.e., polymers having a CDBI of less than 55%. Preferably, the homogeneous ethylene/alpha-olefin copolymers exhibit an essentially singular melting point characteristic, with a peak melting point (T_m), as determined by Differential Scanning Colorimetry (DSC), of from about 60°C to about 105°C. Preferably the homogeneous copolymer has a DSC peak T_m of from about 80°C to about 100°C. As used herein, the phrase "essentially single melting point" means that at least about 80%, by weight, of the material corresponds to a single T_m peak at a temperature within the range of from about 60°C to about 105°C, and essentially no substantial fraction of the material has a peak melting point in excess of about 115°C, as determined by DSC analysis. DSC measurements are made on a Perkin Elmer System 7 Thermal Analysis System. Melting information reported are second melting data, i.e., the sample is heated at a programmed rate of 10°C./min. to a temperature below its critical range. The sample is then reheated (2nd melting) at a programmed rate of 10°C/min.

A homogeneous ethylene/alpha-olefin copolymer can, in general, be prepared by the copolymerization of ethylene and any one or more alpha-olefins. Preferably, the alpha-olefin is a C_3 - C_{20} alpha-monoolefin, more preferably, a C_4 - C_{12} alpha-monoolefin, still more preferably, a C_4 - C_8 alpha-monoolefin. Still more preferably, the alpha-olefin comprises at least one member selected from the group consisting of butene-1, hexene-1, and octene-1, i.e., 1-butene, 1-hexene, and 1-octene, respectively. Most preferably, the alpha-olefin comprises octene-1, and/or a blend of hexene-1 and butene-1.

Processes for preparing and using homogeneous polymers are disclosed in U.S. Patent No. 5,206,075, U.S. Patent No. 5,241,031, and PCT International Application WO 93/03093, each of which is hereby incorporated by reference thereto, in its entirety. Further details regarding the production and use of homogeneous ethylene/alpha-olefin copolymers are disclosed in PCT International Publication Number WO 90/03414, and PCT International Publication Number WO 93/03093, both of which designate Exxon Chemical Patents, Inc. as the Applicant, and both of which are hereby incorporated by reference thereto, in their respective entireties.

Still another genus of homogeneous ethylene/alpha-olefin copolymers is disclosed in U.S. Patent No. 5,272,236, to LAI, et. al., and U.S. Patent No. 5,278,272, to LAI, et. al., both of which are hereby incorporated by reference thereto, in their respective entireties.

As used herein, the term "polyolefin" refers to any polymerized olefin, which can be linear, branched, cyclic, aliphatic, aromatic, substituted, or unsubstituted. More specifically, included in the term polyolefin are homopolymers of olefin, copolymers of olefin, copolymers of an olefin and an non-olefinic comonomer copolymerizable with the olefin, such as vinyl monomers, modified polymers thereof, and the like. Specific examples include polyethylene homopolymer, polypropylene homopolymer, polybutene, ethylene/alpha-olefin copolymer, propylene/alpha-olefin copolymer, butene/alpha-olefin copolymer, ethylene/unsaturated ester copolymer, ethylene/unsaturated acid copolymer, (especially ethyl acrylate copolymer, ethylene/butyl acrylate copolymer, ethylene/methyl acrylate copolymer, ethylene/acrylic acid copolymer, ethylene/methacrylic acid copolymer), modified polyolefin resin, ionomer resin, polymethylpentene, etc. Modified polyolefin resin is inclusive of modified polymer prepared by copolymerizing the homopolymer of the olefin or copolymer thereof with an unsaturated carboxylic acid, e.g., maleic acid, fumaric acid or the like, or a derivative thereof such as the anhydride, ester or metal salt or the like. It could also be obtained by incorporating into the olefin homopolymer or copolymer, an unsaturated carboxylic acid, e.g., maleic acid, fumaric acid or the like, or a derivative thereof such as the anhydride, ester or metal salt or the like.

As used herein, the phrase "anhydride-containing polymer" and "anhydride-modified polymer", means a group containing an anhydride moiety, such as that derived from maleic acid, fumaric acid, etc., has been chemically attached to or affiliated with a given polymer;

As used herein, the term "permeance" (in the packaging industry, "permeance" often is referred to as "transmission rate") means the volume of a gas (e.g., O₂) that passes through a given cross section of film (or layer of a film) at a particular temperature and relative humidity when measured according to a standard test such as, for example, ASTM D 1434 or D 3985.

As used herein, the phrase "ethylene alpha-olefin copolymer", and "ethylene/alpha-olefin copolymer", refer to such heterogeneous materials as linear low density polyethylene

(LLDPE), and very low and ultra low density polyethylene (VLDPE and ULDPE); and homogeneous polymers such as metallocene-catalyzed EXACT[™] linear homogeneous ethylene/alpha olefin copolymer resins obtainable from the Exxon Chemical Company, of Baytown, Texas, bimodal interpenetrating networks comprising heterogeneous and
5 homogeneous ethylene/alpha olefins such as SclairTech resins from NOVA Chemicals LTD of Calgary, Alberta, or Exceed resins from Exxon, or Elite resins from the Dow Chemical Company, and TAFMER[™] linear homogeneous ethylene/alpha-olefin copolymer resins obtainable from the Mitsui Petrochemical Corporation. All these materials generally include copolymers of ethylene with one or more comonomers selected
10 from C₄ to C₁₀ alpha-olefin such as butene-1 (i.e., 1-butene), hexene-1, octene-1, etc. in which the molecules of the copolymers comprise long chains with relatively few side chain branches or cross-linked structures. This molecular structure is to be contrasted with conventional low or medium density polyethylenes which are more highly branched than their respective counterparts. The heterogeneous ethylene/alpha-olefin commonly known
15 as LLDPE has a density usually in the range of from about 0.91 grams per cubic centimeter to about 0.94 grams per cubic centimeter. Other ethylene/alpha-olefin copolymers, such as the long chain branched homogeneous ethylene/alpha-olefin copolymers available from The Dow Chemical Company, known as AFFINITY[™] resins, are also included as another type of homogeneous ethylene/ alpha-olefin copolymer useful in the present invention.

20 In general, the ethylene/alpha-olefin copolymer comprises a copolymer resulting from the copolymerization of from about 80 to about 99 weight percent ethylene and from 1 to about 20 weight percent alpha-olefin. Preferably, the ethylene/alpha-olefin copolymer comprises a copolymer resulting from the copolymerization of from about 85 to about 95 weight percent ethylene and from about 5 to about 15 weight percent alpha-olefin.

25 As used herein, the phrases "inner layer" and "internal layer" refer to any layer, of a multilayer film, having both of its principal surfaces directly adhered to another layer of the film.

As used herein, the phrase "outer layer" refers to any layer of film having less than two of its principal surfaces directly adhered to another layer of the film. The phrase is
30 inclusive of monolayer and multilayer films. In multilayer films, there are two outer layers, each of which has a principal surface adhered to only one other layer of the

multilayer film. In monolayer films, there is only one layer, which, of course, is an outer layer in that neither of its two principal surfaces are adhered to another layer of the film.

As used herein, the phrase "inside layer" refers to the outer layer, of a multilayer film packaging a product, which is closest to the product, relative to the other layers of the multilayer film. "Inside layer" also is used with reference to the innermost layer of a plurality of concentrically arranged layers simultaneously coextruded through an annular die.

As used herein, the phrase "outside layer" refers to the outer layer, of a multilayer film packaging a product, which is furthest from the product relative to the other layers of the multilayer film. The phrase "outside layer" also is used with reference to the outermost layer of a plurality of concentrically arranged layers coextruded through an annular die.

As used herein, the term "adhered" is inclusive of films which are directly adhered to one another using a heat-seal or other means, as well as films which are adhered to one another using an adhesive which is between the two films. As used herein, the phrase "directly adhered", as applied to layers, is defined as adhesion of the subject layer to the object layer, without a tie layer, adhesive, or other layer therebetween. In contrast, as used herein, the word "between", as applied to a layer expressed as being between two other specified layers, includes both direct adherence of the subject layer between to the two other layers it is between, as well as including a lack of direct adherence to either or both of the two other layers the subject layer is between, i.e., one or more additional layers can be imposed between the subject layer and one or more of the layers the subject layer is between.

As used herein; the term "corona treatment" or "corona discharge treatment" means a process in which one or both primary surfaces of a thermoplastic film are subjected to the ionization product of a gas (e.g., air) in close proximity with the film surface(s) so as to cause oxidation and/or other changes to the film surface(s).

As used herein, the term "cook" means to heat a food product thereby effecting a change in one or more of the physical or chemical properties thereof (e.g., color, texture, taste, viscosity, and the like).

As used herein, the term "extrusion" is used with reference to the process of forming continuous shapes by forcing a molten plastic material through a die, followed by

cooling or chemical hardening. Immediately prior to extrusion through the die, the relatively high-viscosity polymeric material is fed into a rotating screw of variable pitch, i.e., an extruder, which forces the polymeric material through the die.

As used herein, the term "coextrusion" refers to the process of extruding two or more materials through a single die with two or more orifices arranged so that the extrudates merge and weld together into a laminar structure before chilling, i.e., quenching. Coextrusion can be employed in film blowing, free film extrusion, and extrusion coating processes.

10 DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The present invention is directed to a heat-shrinkable film suitable for cook-in applications, the film comprising a first layer and a second layer directly adhered to the first layer. The first layer comprises an ethylene/vinyl alcohol copolymer and the second layer comprises at least one member selected from the group consisting of polyester, polyamide and polyurethane. The film of the present invention has a transverse direction free shrink at 50°C of less than about 2% and a transverse direction free shrink at 57°C of at least about 3%.

The multilayer film of the present invention preferably is sequentially or biaxially oriented (preferably at least about 2:1; more preferably at least about 2.3:1; more preferably, at least about 2.4:1; more preferably, at least about 2.5:1, more preferably, at least about 2.6:1; more preferably, at least about 2.7:1; more preferably, at least about 2.8:1; and more preferably, at least about 2.9:1, in at least one direction), more preferably biaxially oriented. More preferably, a total orientation ratio (LRR times TRR) of at least 4; more preferably, at least 5; more preferably, at least 6; more preferably, at least 7; more preferably, at least 7.5; more preferably, at least 8; more preferably, at least 8.5; and more preferably, at least 9 is preferred. Orienting involves initially cooling an extruded film to a solid state (by, for example, cascading water or chilled air quenching) followed by reheating the film to within its orientation temperature range and stretching it. The stretching step can be accomplished in many ways such as by, for example, "trapped bubble" or "tenter framing" techniques, both of which are well known to those skilled in the art. After being heated and stretched, the film is quenched rapidly while being

maintained in its stretched configuration so as to set or lock in the oriented molecular configuration.

Generally, it is preferred that the orientation step be performed at a temperature of at least 90°C, although orientation temperatures of at least 85°C, at least 80°C, at least 5 75°C, at least 70°C, at least 65°C, or even at least 60°C can be adequate for certain end use applications. Similarly, it is preferred that the orientation step be performed at a temperature of less than about 140°C, more preferably less than about 135°C, more preferably less than about 130°C, more preferably less than about 125°C, more preferably less than about 120°C, more preferably less than about 115°C, more preferably less than 10 about 110°C, more preferably less than about 105°C, and most preferably less than about 100°C.

Following orientation, the film of the present invention is preferably cooled and then heated to an elevated temperature, most preferably to an elevated temperature less than the orientation temperature. This reheating step, which may be referred to as 15 annealing or heat setting, is performed in order to provide film of uniform flat width. As is discussed in greater detail above, annealing to dimensionally stabilize film is well known. In accordance with the present invention, the oriented film is heated to an elevated temperature in order to provide a film which is substantially shrink-free in the transverse direction at 50°C but which possesses at least 3% transverse free shrink at 57°C. The 20 phrase "substantially shrink-free in the transverse direction" as used herein refers to films having less than 3% free shrink in the transverse direction, more preferably less than 2% free shrink in the transverse direction, most preferably less than 1% free shrink in the transverse direction, at the designated temperature.

Thus, it is preferred that the film has a transverse direction free shrink at 40°C of 25 less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

It also is preferred that the film has a transverse direction free shrink at 42°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

It also is preferred that the film has a transverse direction free shrink at 44°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

5 It also is preferred that the film has a transverse direction free shrink at 46°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

It also is preferred that the film has a transverse direction free shrink at 48°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

10 It also is preferred that the film has a transverse direction free shrink at 50°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

It also is preferred that the film has a transverse direction free shrink at 52°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

15 It also is preferred that the film has a transverse direction free shrink at 54°C of less than about 3%; more preferably, less than about 2%; and more preferably, less than about 1%.

20 Preferably, the film has a transverse direction free shrink at 57°C of at least about 4%; more preferably, at least about 5%; more preferably, at least about 6%; more preferably, at least about 7%; and more preferably, at least about 8%. Similar values are preferred for the longitudinal direction free shrink.

25 Preferably, the film also has a transverse direction free shrink at 57°C of less than about 15%; more preferably, less than about 12%; more preferably, less than about 11%; more preferably, less than about 10%; and more preferably, less than about 9%. In certain specific embodiments, the transverse direction free shrink at 57°C is more preferably less than about 8%; more preferably, less than about 7%; and even more preferably, less than about 6%.

30 Also, preferably, the film has a transverse direction free shrink at 80°C of less than about 45%; more preferably, less than about 40%; more preferably, less than about 35%; more preferably, less than about 30%; more preferably, less than about 28%; more

preferably, less than about 26%; more preferably, less than about 25%, more preferably, less than about 24%; more preferably, less than about 23%; more preferably, less than about 22%; more preferably, less than about 21%; more preferably, less than about 20%; and more preferably, less than about 19%. Similar values are preferred for the longitudinal direction free shrink.

Also, preferably, the transverse direction free shrink at 80°C is at least 5%; more preferably, at least 8%; more preferably, at least 10%; more preferably, at least 12%; more preferably, at least 14%; more preferably, at least about 15%; more preferably, at least about 16%; more preferably, at least about 17%; and more preferably, at least about 18%. Similar values are preferred for the longitudinal direction free shrink.

Preferably, the film exhibits a transverse direction shrink tension at 57°C of at least about 0.1 MPa; more preferably, at least about 0.2 MPa; more preferably, at least about 0.3 MPa; more preferably, at least about 0.4 MPa; more preferably, at least about 0.5 MPa; more preferably, at least about 0.6 MPa; more preferably, at least about 0.7 MPa; more preferably, at least about 0.75 MPa; more preferably, at least about 0.8 MPa; and more preferably, at least about 0.85 MPa.

Preferably, the film exhibits a longitudinal direction shrink tension at 57°C of at least about 0.1 MPa; more preferably, at least about 0.30 MPa; more preferably, at least about 0.50 MPa; more preferably, at least about 0.70 MPa; more preferably, at least about 0.80 MPa; more preferably, at least about 0.85 MPa; more preferably, at least about 0.90 MPa; and more preferably, at least about 0.95 MPa.

Preferably, the film exhibits a transverse direction shrink tension at 80°C of at least about 0.7 MPa; more preferably, at least about 0.9 MPa; more preferably, at least about 1.1 MPa; more preferably, at least about 1.2 MPa; more preferably, at least about 1.3 MPa; more preferably, at least about 1.4 MPa; more preferably, at least about 1.5 MPa; and more preferably, at least about 1.6 MPa. Similar values are preferred for the longitudinal direction shrink tension at 80°C.

In a preferred embodiment, the longitudinal direction shrink tension at both 57°C and 80°C is from about 50% to about 150% of the transverse direction shrink tension at those corresponding temperatures; more preferably, from about 70% to about 130% of the transverse direction shrink tension at those corresponding temperatures; more preferably,

from about 80% to about 120% of the transverse direction shrink tension at those corresponding temperatures; and even more preferably, from about 85% to about 115% of the transverse direction shrink tension at those temperatures.

The process of heating the oriented film to an elevated temperature to dimensionally stabilize it (by reducing the transverse direction free shrink) involves exposing the film to a environment with a temperature of greater than 35°C, preferably, greater than 40°C, preferably, greater than 43°C, preferably, greater than 46°C, more preferably, greater than 50°C. The actual time of exposure depends on the process employed to transfer heat to the film. For example, if the film is exposed to a heated gaseous environment for very short periods of time (of the order of a few seconds), the temperature of the environment could be as high as 200°C. However, preferably, temperatures of less than about 160°C; more preferably, less than about 120°C; more preferably, less than about 100°C; more preferably, less than about 80°C; more preferably, less than about 70°C; more preferably, less than about 60°C; and more preferably, less than about 55°C; are preferred. Also, preferably, the temperature to which the film is exposed is greater than about 35°C; more preferably, greater than about 40°C; more preferably, greater than about 42°C; more preferably, greater than about 44°C; more preferably, greater than about 46°C; more preferably, greater than about 48°C; and more preferably, greater than about 50°C.

The time of exposure can be several hours or less than a fraction of a second. Preferably, the time of exposure is less than 1 minute, more preferably, less than 30 seconds, more preferably, less than 20 seconds, more preferably, less than 10 seconds; more preferably, less than 5 seconds; more preferably, less than 2 seconds; more preferably, less than 1 second; and more preferably, less than ½ of one second.

However, in a preferred embodiment, the film is in contact with a heated surface which is at an elevated temperature. Preferably, this involves bringing a moving web into contact with a heated surface. This mechanism provides quicker and more consistent heat-transfer to the film and results in a product which is more consistent (in width and shrink properties). Preferably, the temperature of the heated surface to which the film is exposed is less than 200°C; more preferably, less than about 120°C; more preferably, less than about 100°C; more preferably, less than about 80°C; more preferably, less than about

70°C; more preferably, less than about 65°C; more preferably, less than about 63°C; more preferably, less than about 61°C; more preferably, less than about 59°C; more preferably, less than about 57°C; more preferably, less than about 55°C; and more preferably, less than about 53°C. Also, preferably, the temperature of the heated surface to which the film is exposed is greater than about 35°C; more preferably, greater than about 40°C; more preferably, greater than about 42°C; more preferably, greater than about 44°C; more preferably, greater than about 46°C; more preferably, greater than about 48°C; and more preferably, greater than about 50°C.

More preferably, when the film is annealed (i.e., heated to an elevated temperature) to dimensionally stabilize said film, the temperature of the film reaches at least 34°C; more preferably, at least about 36°C; more preferably, at least about 38°C; more preferably, at least about 40°C; more preferably, at least about 42°C; more preferably, at least about 44°C; more preferably, at least about 46°C; more preferably, at least about 48°C; more preferably, at least about 50°C; and more preferably, at least about 52°C. Also, preferably, the temperature which the film reaches is less than about 100°C; more preferably, less than about 90°C; more preferably, less than about 80°C; more preferably, less than about 70°C; more preferably, less than about 66°C; more preferably, less than about 64°C; more preferably, less than about 62°C; more preferably, less than about 60°C; more preferably, less than about 58°C; more preferably, less than about 56°C; and more preferably, less than about 54°C.

The time to which the film is exposed to this heated surface can range from several hours to less than a fraction of a second. Preferably, the time of exposure is less than 5 minutes; more preferably, less than 3 minutes; more preferably, less than 1 minute; more preferably, less than 30 seconds, more preferably, less than 20 seconds, more preferably, less than 10 seconds; more preferably, less than 5 seconds; more preferably, less than 2 seconds; more preferably, less than 1 second; and more preferably, less than 0.8 seconds; more preferably, less than 0.6 seconds and even more preferably, less than 0.4 seconds.

The film can be annealed or heated to an elevated temperature either in-line with (and subsequent to) or off-line from (in a separate process) the orientation process. For

example, annealing can be performed as a part of the shirring process. However, an annealing process which is in-line with the orientation process is preferred.

While any mechanism known to those of skill in the art can be used to transfer heat to the film of the invention so that it is heated to an elevated temperature, preferably, the heat-transfer mechanism is conduction or convection; more preferably, conduction. Preferably, the film of the present invention is heated to an elevated temperature by bringing it in contact with a heated surface or surfaces followed by cooling of the film. Preferably, the heated surfaces are rolls which are subjected to the temperatures described *supra*.

Furthermore, the film can be annealed or heated to an elevated temperature while it is in the form of a relatively flat and collapsed film or when it is inflated or non-flat, the latter typically achieved by inflating the film with a fluid, preferably a gas such as air. The process of annealing or heat-setting of the oriented film of the present invention, wherein it is heated to an elevated temperature, can be conducted when the film is either constrained in the transverse direction or when it is unconstrained in the transverse direction. Optionally, the film may be constrained in the transverse direction by inflation with a fluid.

While it is preferred that a film having shrink characteristics in accordance with the present invention is made by orienting and subsequently annealing a preliminary film material, it is also within the scope of the present invention to provide such a film by other methods. For example, a film having the present desired shrink characteristics may be provided by orienting a preliminary film material under controlled conditions without a subsequent annealing step. Similarly, it may be possible to omit the orientation step if a film in accordance with the present invention is hot blown during the coextrusion process under the proper conditions.

Regardless of the method employed in making the present film, the first layer comprises an ethylene/vinyl alcohol copolymer. The EVOH is preferably hydrolyzed to at least about 50%, more preferably to at least about 95%, and more preferably to at least about 99%. Preferably, the EVOH comprises from about 28 to about 48 mole percent ethylene mer; more preferably, from about 32 to about 44 mole percent ethylene mer; and

more preferably, from about 38 mole percent ethylene to about 44 mole percent ethylene mer.

However, the first layer can comprise other polymers in an amount of from about 1 to about 95 weight percent (more preferably, 5-80%; more preferably, 5-60%; more preferably, 5-50%; more preferably, 5-40%; more preferably, 5-30%; more preferably, 10-30%; more preferably, 10-25%; more preferably, 10-20%). Polymers which can be included in the first layer include polyamides, polyesters, polyurethane, and polyolefins. Preferred blending polymers include polyamides, and modified polyolefins. The preferred polyamides, polyesters and polyolefins are described below in the description of the second layer and third layer. However, most preferably, the first layer comprises EVOH in an amount which is at least about 30%; more preferably, at least about 50%; more preferably, at least about 60%; more preferably, at least about 70%; more preferably, at least about 75%; more preferably, at least about 80%; more preferably, at least about 85%; more preferably, at least about 90%; and more preferably, at least about 95%, based on the weight of the first layer. In one preferred embodiment, the first layer consists essentially of ethylene/vinyl alcohol copolymer.

Preferably, the first layer has a low permeance to oxygen, preferably an oxygen permeance of no more than about (in ascending order of preference) 150 cm³/m²·atm·24 hours, 100 cm³/m²·atm·24 hours, 75 cm³/m²·atm·24 hours, 60 cm³/m²·atm·24 hours, 50 cm³/m²·atm·24 hours, 40 cm³/m²·atm·24 hours, 30 cm³/m²·atm·24 hours, 25 cm³/m²·atm·24 hours, 20 cm³/m²·atm·24 hours, 15 cm³/m²·atm·24 hours, and 10 cm³/m²·atm·24 hours (at 25°C and 0% relative humidity).

The first layer preferably has a thickness of from about 0.001 to about 0.05 mm, more preferably from about 0.00125 to about 0.02 mm, even more preferably from about 0.002 to about 0.01 mm, and most preferably from about 0.0025 to about 0.005 mm. The thickness of the first layer preferably is from about 1 to about 70%, more preferably from about 2 to about 50%, even more preferably from about 3 to about 40%, still more preferably from about 4 to about 30%, yet still more preferably from about 5 to about 25%, and most preferably from about 5 to about 15%, based on the total thickness of the multilayer film. The film can comprises 1 or more layers as described in the above

description of the first layer. Although the first layer as described herein may be an outer layer, it is most preferably an internal layer.

Preferably, the multilayer film of the present invention has an oxygen permeance of no more than about (in ascending order of preference) 150 cm³/m²·atm·24 hours, 100
5 cm³/m²·atm·24 hours, 75 cm³/m²·atm·24 hours, 60 cm³/m²·atm·24 hours, 50
cm³/m²·atm·24 hours, 40 cm³/m²·atm·24 hours, 30 cm³/m²·atm·24 hours, 25
cm³/m²·atm·24 hours, 20 cm³/m²·atm·24 hours, 15 cm³/m²·atm·24 hours, and 10
cm³/m²·atm·24 hours (at 25°C and 0% Relative Humidity).

The second layer is directly adhered to the first layer and preferably comprises at
10 least one member selected from the group consisting of polyester, polyamide and
polyurethane. In a preferred embodiment, the second layer comprises a polyamide.
Preferably, the polyamide comprises at least one member selected from the group
consisting of polyamide 6, polyamide 9, polyamide 10, polyamide 11, polyamide 12,
polyamide 66, polyamide 610, polyamide 612, polyamide 6I, polyamide 6T, polyamide 69,
15 and copolymers thereof. Still more preferably, the second layer comprises at least one
member selected from the group consisting of polyamide 6, polyamide 66 and
copolyamide 6/66. Preferably, the polyamide has a melting point of from about 130°C to
about 270°C; more preferably, from about 130°C to about 235°C; more preferably, from
about 140°C to about 235°C; more preferably, from about 160°C to about 235°C; more
20 preferably, from about 180°C to about 235°C; and more preferably, from about 190°C to
about 235°C. Optionally, the second layer can comprise an amorphous polyamide. In a
preferred embodiment, the second layer comprises two polyamides as described supra;
preferably, a blend of a first polyamide having a melting point greater than about 180°C
(more preferably, greater than about 190°C; and more preferably, greater than about
25 200°C) with a second polyamide having a melting point less than about 180°C (more
preferably, less than about 170°C; more preferably, less than about 160°C). Optionally,
the blend can comprise any two polyamides as described above as long as they have a
different chemical structure and/or crystal structure. Thus, the polyamide, as preferred in
the second layer, could comprise a blend of two polyamides, each with a melting point
30 between 135°C and 260°C. In a preferred embodiment, the polyamide comprises at least
about 30% by weight (of the layer) of at least one member selected from the group

consisting of polyamide 6, polyamide 66 and copolyamide 6/66; more preferably, at least 40%; more preferably, at least 50%; more preferably, at least 60%; and more preferably, at least 70% (by weight) of polyamide 6, polyamide 66 or copolyamide 6/66.

In another preferred embodiment, the second layer comprises a polyester.

- 5 Preferably, the polyester has a melting point of from about 130°C to about 260°C; more preferably, from about 150°C to about 250°C; even more preferably from about 170°C to about 250°C; still more preferably, from about 180°C to about 240°C; still more preferably, from about 190°C to about 240°C; still more preferably, from about 200°C to about 240°C; and yet still more preferably, from about 210°C to about 235°C. Preferably,
- 10 the polyester has a terephthalic acid mer content of at least 75 mole percent; more preferably, at least 80 mole percent; more preferably, at least 85 mole percent; and even more preferably, at least 90 mole percent. In another preferred embodiment, the polyester in the second layer is an amorphous polyester, more preferably, an amorphous copolyester. Examples of suitable polyesters include PET homopolymer, PET copolymer, PEN
- 15 homopolymer, and PEN copolymer.

- The second layer preferably has a thickness of from about 0.001 to about 0.1 mm; more preferably from about 0.002 to about 0.05 mm; more preferably, from about 0.003 mm to about 0.03 mm; and more preferably, from about 0.005 to about 0.02 mm. Preferably, the thickness of the second layer is from about 1 to about 70 percent, based on
- 20 total film thickness; more preferably, from about 5 to about 50 percent; more preferably, from about 8 to about 50 percent; more preferably, from about 10 to about 45 percent; more preferably, from about 13 to about 40 percent; more preferably, from about 15 to about 35 percent; more preferably, from about 17 to about 25 percent; and more preferably, from about 20 to about 25 percent. In one preferred embodiment, the second
- 25 layer has a thickness of at least about 10%; more preferably, at least 15%; more preferably, at least 20%; more preferably, at least about 25%; more preferably, at least about 30%; more preferably, at least about 35%; and even more preferably, at least about 40%, based on the total thickness of the multilayer film.

- The second layer can include about 50% (by wt.), more preferably at least about
- 30 60% (by wt.), even more preferably at least about 70% (by wt.), still more preferably at least about 80% (by wt.), and most preferably at least about 90% (by wt.) of the polymers

described supra in the description of the second layer. The second layer can optionally include at least about 5% (by wt.), more preferably at least about 10% (by wt.), even more preferably at least about 20% (by wt.), still more preferably at least about 40% (by wt.), and most preferably at least about 50% (by wt.) of one or more polymers. Useful blending polymers include, but are not limited to, polyolefins, polystyrene, EVOH, PVDC, polyether, polyurethane, polycarbonate, and the like. In one preferred embodiment, the second layer consists essentially of one or more members selected from the group consisting of polyester, polyamide and polyurethane.

Preferably, the film further comprises a third layer. The third layer could either be an internal layer or an outer layer. When the third layer is an outer layer of a package, it could either be the inside layer or the outside layer. The third layer could be directly adhered to the first layer or have one or more layers between it and the first layer. Preferably, the third layer comprises at least one member selected from the group consisting of polyolefin, polystyrene, polyamide, polyester and polyurethane (the preferred polyamide and polyester are as described in the description of the first layer); more preferably, at least one member selected from the group consisting of polyethylene homopolymer, polyethylene copolymer, polypropylene homopolymer, polypropylene copolymer, polybutene homopolymer, polybutene copolymer (the polyolefin could be a homogeneous or a heterogeneous polyolefin).

In one preferred embodiment, the third layer serves as the food-contact layer and comprises a polymer as described supra in the broad description of the third layer. However, more preferably, the third layer comprises a polymer having a surface energy of at least about 0.034 J/m²; more preferably at least about 0.036 J/m²; more preferably at least about 0.038 J/m², more preferably at least about 0.040 J/m²; more preferably at least about 0.042 J/m²; more preferably at least about 0.044 J/m²; and more preferably at least about 0.046 J/m². While the third layer does not have to be corona treated, in an optional embodiment, the third layer is corona treated.

The third layer preferably comprises a polar polymer, preferably one comprising functional groups that include oxygen and/or nitrogen moieties; preferably, at least one member selected from the group consisting of olefin/unsaturated acid copolymer, anhydride-containing polyolefin, polyamide and polyester. Preferably, the third layer

comprises at least one member selected from the group consisting of an ethylene/unsaturated acid copolymer, propylene/unsaturated acid copolymer, butene/unsaturated acid copolymer and polyamide; more preferably, at least one member selected from the group consisting of ethylene/unsaturated acid copolymer and polyamide.

5 The surface energy of the polymers (sometimes also referred to as surface tension), as described here in the description of the third layer, is preferably obtained at 20°C from wettability data, as is well known to those of skill in the art. Preferably, the geometric mean method is used to calculate the surface energy with the preferred solvents used including water and methylene iodide. Optionally, the surface energy of the polymers
10 referenced here can be obtained from cohesive energy data or dyne solutions. Using the techniques referenced above, polymers such as LLDPE, EVA and polypropylene homopolymer will, in general, have a surface energy less than about 0.034 J/m². On the other hand, most preferred polymers of the food-contact layer in the films of this invention have surface energies typically higher than 0.034 J/m². For example, polyethylene
15 terephthalate (a polyester) has a surface energy of about 0.043 J/m², polyamide 6 has a surface energy of about 0.044 J/m² and some ionomerized ethylene/acrylic acid copolymers have a surface energy of about 0.040 J/m².

 In a preferred embodiment, the third layer comprises an ethylene/unsaturated acid copolymer comprising at least about 2% unsaturated acid mer (by weight); more
20 preferably, at least about 4% unsaturated acid mer; more preferably, at least about 6% unsaturated acid mer; more preferably, at least about 7% unsaturated acid mer; and more preferably, at least about 8% unsaturated acid mer. Preferably, the unsaturated acid is a C3-C20 unsaturated acid, more preferably a C3-C10 unsaturated acid; more preferably, a C3-C5 unsaturated acid. Preferably, the unsaturated acid is acrylic acid; more preferably,
25 at least one member selected from the group consisting of acrylic acid and methacrylic acid. In one preferred embodiment, the olefin/unsaturated acid copolymer is ionomerized; Preferably, the ionomer is an ionomer of an ethylene/acrylic acid copolymer; examples include SURLYN™ ionomer resins (E.I. DuPont de Nemours, of Wilmington, Delaware).

30 In another preferred embodiment, the third layer comprises a polyamide, preferably, as described supra in the description of the second layer. Optionally, the third

layer can comprise a polyester, preferably, as described supra in the description of the second layer. Optionally, the third layer can comprise an anhydride-containing polyolefin; preferably, an anhydride-grafted polyolefin. The anhydride containing polyolefin can be a block copolymer, a random copolymer or a graft copolymer. Preferred examples include ethylene/unsaturated ester/maleic anhydride copolymers, sold commercially under the trade name LOTADER TM by Elf-Atochem; and polymers sold commercially under the trade name BYNEL TM by E.I. DuPont de Nemours (the latter referring to anhydride containing copolymers where the anhydride moiety is incorporated into the polyolefin by a grafting technique). The incorporation of polyamide or polyester is especially preferred if the third layer is an outer layer which is printed because of superior ink adhesion.

The third layer can include about 50% (by wt.), more preferably at least about 60% (by wt.), even more preferably at least about 70% (by wt.), still more preferably at least about 80% (by wt.), and most preferably at least about 90% (by wt.) of the polymers described supra in the description of the third layer. However, where desired to change or enhance the properties of the third layer, the polymers described supra can be blended with up to about 95% (by wt.); more preferably, up to about 90%; more preferably, up to about 70%; more preferably, up to about 50%; more preferably, up to about 30%; more preferably, up to about 20%; and more preferably, up to about 10% of one or more other polymers. Useful blending polymers include, but are not limited to, polyolefins, polystyrene, polyamides, polyesters, EVOH, PVDC, polyether, polyurethane, polycarbonate, and the like. Preferred among these are those polymers that include mer units derived from ethylene, propylene, and 1-butene; more preferably, at least one member selected from the group consisting of polyethylene homopolymer, polyethylene copolymer, polypropylene homopolymer, polypropylene copolymer, polybutene homopolymer, and polybutene copolymer; more preferably, at least one member selected from the group consisting of ethylene/alpha-olefin copolymer, propylene/alpha-olefin copolymer, butene/alpha-olefin copolymer, ethylene/unsaturated acid copolymer, and ethylene/unsaturated ester copolymer; and more preferably, at least one member selected from the group consisting of linear low density polyethylene (LLDPE), ethylene vinyl acetate (EVA), propylene/ethylene copolymer, and propylene/butene copolymer. In one

preferred embodiment, the third layer comprises a blend (or alloy) of a polyamide and a polyolefin (preferably, an ethylene/unsaturated acid copolymer).

In some instances, the third layer preferably can include (or consist essentially of) only those polymers containing mer units derived from C2-C12 alpha-olefins, ethylenically unsaturated acids, and/or unsaturated esters. Optionally, the third layer can consist essentially of only polyamide and/or polyester.

In the case when the third layer serves as the food-contact layer, it preferably offers adequate adhesion to a wide variety of proteinaceous products, even in the absence of corona treatment. The food contact layers of this invention preferably provide consistent film-to-food adhesion over time.

However, in another preferred embodiment, the third layer is relatively non-polar and preferably, does not adhere to the food-product. One example of such an applications is where the film of this invention is used for the packaging of whole muscle products where adhesion of the film to the 'whole muscle' product can result in the film stripping of big chunks of meat from the surface of the product and providing an unsightly appearance. In these embodiments, the food-contact layer preferably comprises a polymer having a surface energy less than about 0.034 J/m²; more preferably, less than about 0.033 J/m²; more preferably, less than about 0.032 J/m²; more preferably, less than about 0.031 J/m²; and more preferably, less than about 0.030 J/m². Examples of preferred polymers in this embodiment include ethylene alpha-olefin copolymers, LDPEs, EVAs, and polypropylene.

The third layer can also serve as the outside layer of a packaged product (i.e., the third layer is an outer layer). Optionally, the third layer can also serve as an internal layer in the films of this invention. The third layer could serve as either a core or bulk layer or a tie-layer. The film could have 1-10 different layers having the composition as described in the description of the third layer, more preferably, 1-7, and more preferably, 1-5 layers.

The third layer preferably has a thickness of from about 0.0025 to about 0.1 mm, more preferably from about 0.005 to about 0.04 mm, even more preferably from about 0.0075 to about 0.025 mm, and most preferably from about 0.01 to about 0.02 mm. Generally, the thickness of the third layer is from about 1 to about 70%, preferably from about 5 to about 50%, more preferably from about 10 to about 40%, even more preferably from about 12 to about 35%, and still more preferably from about 15 to about 30% of the

total thickness of the multilayer film. In one preferred embodiment, the third layer has a thickness of at least about 10%; more preferably, at least 15%; more preferably, at least 20%; more preferably, at least about 25%; more preferably, at least about 30%; more preferably, at least about 35%; and even more preferably, at least about 40% of the total thickness of the multilayer film.

Preferably, the polymer of the third layer has a melt index of from about 0.3 to about 50; more preferably from about 0.5 to about 20; still more preferably from about 0.7 to about 10; even more preferably from about 1 to about 8; and, still more preferably from about 1 to about 6 (as measured by ASTM D1238; the teaching of which is hereby incorporated, in its entirety, by reference thereto).

Preferably, the film comprises a fourth layer, preferably as described above in the description of the third layer. However, in a most preferred embodiment, the fourth layer serves as a tie-layer. As a general rule, tie layers should have a relatively high degree of compatibility with layers comprising EVOH, polyamide, polyester, PVDC, etc., as well as non-barrier layers, such as polyolefins. The composition, number, and thickness of tie layers is as known to those of skill in the art. Such a tie layer can have a thickness of from about 0.001 to about 0.05 mm, more preferably from about 0.0015 to about 0.025 mm, even more preferably from about 0.0025 to about 0.01 mm, and most preferably from about 0.003 to about 0.008 mm. Preferably, the tie layer has a thickness of from about 1 to about 70% of the total thickness of the multilayer film; more preferably, from about 1 to about 40%; more preferably, from about 2 to about 30%; more preferably, from about 2 to about 20%; more preferably, from about 2 to about 15%; more preferably, from about 2 to about 10%; and more preferably, from about 2 to about 5%. Such tie layers can include one or more polymers that contain mer units derived from at least one of C2-C12 alpha-olefin, styrene, amide, ester, and urethane, preferably one or more of anhydride-grafted ethylene/alpha-olefin interpolymers, anhydride-grafted ethylene/ethylenically unsaturated ester interpolymers, and anhydride-grafted ethylene/ethylenically unsaturated acid interpolymers.

In general, the film can comprise 1 or more tie-layers; more preferably, 1-5 tie-layers.

Preferably, the film further comprises another layer comprising at least one member selected from the group consisting of polyester and polyamide. The preferred polyester and polyamide are described above in the description of the second layer. Such layers preferably have a thickness of from about 0.001 mm to about 0.1 mm, more preferably from about 0.0025 to about 0.05 mm, and most preferably from about 0.005 to about 0.025 mm. The thickness preferably is from about 1 to about 70%, more preferably from about 5 to about 60%, even more preferably from about 10 to about 50%, still more preferably from about 15 to about 45%, and most preferably from about 25 to about 40% based on the total thickness of the multilayer film.

In one preferred embodiment, the multilayer film comprises at least 40% by weight of those polymers containing mer units derived from C2-C12 alpha-olefins, ethylenically unsaturated acids, and/or unsaturated esters (more preferably, at least 50%; more preferably, at least 60%; more preferably, at least 70%; and more preferably, at least 80%).

In another preferred embodiment, the multilayer film comprises at least 20% polyolefin (by weight); more preferably, at least 30% polyolefin; more preferably, at least 40% polyolefin; more preferably, at least 50% polyolefin; more preferably, at least 55% polyolefin; more preferably, at least 60% polyolefin; more preferably, at least 65% polyolefin; more preferably, at least 70% polyolefin; more preferably, at least 75% polyolefin; and more preferably, at least 80% polyolefin. In another preferred

embodiment, the film comprises less than about 90% polyolefin by weight; more preferably, less than about 85% polyolefin; more preferably, less than about 80% polyolefin; more preferably, less than about 70% polyolefin; more preferably, less than about 60% polyolefin; more preferably, less than about 50% polyolefin; and more preferably, less than about 40% polyolefin. Optionally, the multilayer film preferably comprises from about 0-90% polyolefin (by weight); more preferably, 10-85% polyolefin; more preferably, 30-80% polyolefin; more preferably, 40-75% polyolefin; more preferably, 45-75% polyolefin; more preferably, 50-70% polyolefin; and more preferably, 55-70% polyolefin.

In another embodiment, the multilayer film comprises less than 80% polyamide (by weight); more preferably, less than 70% polyamide; more preferably, less than 60% polyamide; more preferably, less than 55% polyamide; more preferably, less than 50%

polyamide; more preferably; less than 45% polyamide; more preferably, less than 40% polyamide; more preferably, less than 35% polyamide; and more preferably, less than 30% polyamide. Also, preferably, the multilayer film comprises at least 10% polyamide by weight (more preferably, at least 15%; more preferably, at least 20%; more preferably, at least 25%; more preferably, at least 30%; and more preferably, at least 40%). Optionally, the multilayer film comprises from about 0-80% polyamide (by weight); more preferably, about 5-70% polyamide; more preferably, from about 10-60% polyamide; more preferably, from about 15-60% polyamide; more preferably, from about 15-55% polyamide; more preferably, from about 15-50% polyamide; more preferably, from about 15-45% polyamide; and more preferably, from about 20-40% polyamide. The range of preferred polyamide (based on total weight of the film) described supra is especially preferred when the polyamide is selected from the group consisting of polyamide 6, polyamide 66 and polyamide 6/66 (the range is however also applicable to any of the polyamides described above). Thus, in a preferred embodiment, the multilayer film of the invention comprises less than 80% polyamide 6, polyamide 66 and copolyamide 6/66; more preferably, less than 70% polyamide 6, polyamide 66 and copolyamide 6/66, etc.

In another embodiment, the multilayer film comprises less than 80% polyester (by weight); more preferably, less than 70% polyester; more preferably, less than 60% polyester; more preferably, less than 55% polyester; more preferably, less than 50% polyester; more preferably; less than 45% polyester; more preferably, less than 40% polyester; more preferably, less than 35% polyester; and more preferably, less than 30% polyester. Optionally, the multilayer film comprises from about 0-80% polyester (by weight); more preferably, from about 5-70% polyester; more preferably, from about 10-60% polyester; more preferably, from about 15-60% polyester; more preferably, from about 20-55% polyester; more preferably, from about 20-50% polyester; more preferably, from about 20-45% polyester; and more preferably, from about 20-40% polyester.

In a preferred embodiment, the thickness of the second layer is at least 50% of the thickness of the first layer; more preferably, at least 60%; more preferably, at least 70%; more preferably, at least 80%; more preferably, at least 90%; more preferably, at least 100%; more preferably, at least 110%; and more preferably, at least 125%. Furthermore, in a most preferred embodiment, the amount of EVOH in the multilayer film is less than

the total amount of polyester, polyamide or polyurethane in the multilayer film (more preferably, less than 90%; more preferably, less than 80%; and more preferably, less than 70% of the total amount of polyester, polyamide or polyurethane in the multilayer film). These preferred embodiments are believed to provide films with superior inter-ply bond strength, less delamination tendency and less tubing striations, wrinkles and creases. In a most preferred embodiment, the first layer is directly adhered to the second layer on one surface and to a third layer on the other surface, the third layer comprising at least one member selected from the group consisting of polyester, polyamide and polyurethane. Preferably, both the layers adjacent to the first layer have a thickness of at least 50% of the thickness of the first layer, as described above, more preferably 75%, most preferably, 100%. In a preferred embodiment the thickness of the first layer can be as much as 50%, 60%, 70%, 80%, 90%, or 100% of the thickness of the second layer. In general, the greater the thickness of the second layer, the better the delamination resistance.

It is an object of the present invention to provide a film which is substantially delamination resistant. By the term "substantially delamination resistant" reference is made to a film which has an inter-ply bond strength at least 0.10 lbs/inch, more preferably 0.20 lbs/inch, more preferably 0.25 lbs/inch, more preferably 0.30 lbs/inch, more preferably 0.35 lbs/inch, more preferably 0.40 lbs/inch, more preferably 0.45 lbs/inch, more preferably 0.50 lbs/inch.

The film can have additional layers, these layers preferably have a thickness and composition similar to the layers described supra.

The multilayer film of the present invention preferably exhibits a sufficient Young's modulus so as to withstand normal handling and use conditions. It preferably has a Young's modulus of at least about 200 MPa; more preferably, at least about 230 MPa; more preferably, at least about 260 MPa; more preferably, at least about 300 MPa; more preferably, at least about 330 MPa; more preferably, at least about 360 MPa; and more preferably, at least about 400 MPa. (Young's modulus is measured in accordance with ASTM D 882, the teaching of which is incorporated herein by reference.) More preferably, the Young's modulus is less than about 2000 MPa; more preferably, less than about 1500 MPa; more preferably, less than about 1000 MPa; more preferably, less than about 800 MPa; more preferably, less than about 700 MPa; more preferably, less than

about 650 MPa; more preferably, less than about 600 MPa; more preferably, less than about 550 MPa; and more preferably, less than about 500 MPa.

Preferably, the film according to the present invention comprises a total of from 2 to 20 layers; more preferably, from 2 to 12 layers; more preferably, from 2 to 9 layers; 5 more preferably, from 3 to 8 layers. Optionally, the multilayer film of the invention consists of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12 layers.

While adjacent layers can have the same or similar composition, preferably, adjacent layers have different compositions.

Preferably, the film has a thickness uniformity of at least 20 percent; more 10 preferably, at least 30 percent; still more preferably, at least 40 percent; yet still more preferably, at least 50 percent; even yet still more preferably, at least 60 percent; still more preferably, at least 70 percent; still more preferably, at least 80 percent; and, still more preferably, at least 85 percent.

The multilayer film of the present invention can have any total thickness desired, 15 so long as the film provides the desired properties, e.g. elastic recovery, shrink force, optics, modulus, seal strength, etc., for the particular packaging operation in which the film is used. The multilayer film of the present invention preferably has a total thickness of from about 0.0075 to about 0.25 mm, more preferably from about 0.0125 to about 0.125 mm, more preferably from about 0.025 to about 0.1 mm, even more preferably from about 20 0.035 to about 0.09 mm; more preferably, from about 0.040 to about 0.075 mm; more preferably from about 0.040 to about 0.070 mm; more preferably, from about 0.045 to about 0.065 mm; more preferably, from about 0.050 to about 0.065 mm; and more preferably, from about 0.055 to about 0.065 mm. The range of thicknesses mentioned above is also important because of the influence that orientation ratios and annealing have 25 on film inter-ply strength and quality. It is believed that the preferred thickness ranges disclosed above will provide the more robust structures.

The multilayer film of the present invention can be irradiated and/or corona treated. The former technique involves subjecting a film material to radiation such as corona discharge, plasma, flame, ultraviolet, X-ray, gamma ray, beta ray, or high energy electron 30 treatment, any of which can alter the surface of the film and/or induce crosslinking between molecules of the polymers contained therein. The use of ionizing radiation for

crosslinking polymers present in a film structure is disclosed in U.S. Patent No. 4,064,296 (Bornstein et al.), the teaching of which is incorporated herein by reference. Irradiation can produce a cross-linked polymer network and is believed to enhance the ability of the film to form a tight package around a cooked meat-product. Additionally, it also facilitates the orientation process, and is also believed to improve the inter-ply adhesion between the layers, reduce edge tear, and give the film superior structural integrity and guts to better survive cook-in conditions.

Radiation dosages are referred to herein in terms of the radiation unit "RAD", with one million RADS, also known as a megarad, being designated as "MR", or, in terms of the radiation unit kiloGray (kGy), with 10 kiloGray representing 1 MR, as is known to those of skill in the art. To produce crosslinking, the polymer is subjected to a suitable radiation dosage of high energy electrons, preferably using an electron accelerator, with a dosage level being determined by standard dosimetry methods. A suitable radiation dosage of high energy electrons is in the range of up to about 13-166 kGy, more preferably about 30-139 kGy, and still more preferably, 50-100 kGy. In certain embodiments, especially when the film of the invention is to be converted into bags, a lower radiation dosage is preferred. In such a scenario, a radiation dosage of from about 0-100 kGy; more preferably, 0-80 kGy; more preferably, 0-70 kGy; more preferably, 0-60 kGy; and more preferably, 0-40 kGy is preferred. Preferably, irradiation is carried out by an electron accelerator and the dosage level is determined by standard dosimetry methods. However, other accelerators such as a Van de Graaff or resonating transformer may be used. The radiation is not limited to electrons from an accelerator since any ionizing radiation may be used. A preferred amount of radiation is dependent upon the film and its end use.

If desired or necessary to increase adhesion to an enclosed meat product or for printing, all or a portion of the film of the present invention can be corona and/or plasma treated. For enhancing adhesion of the film to an enclosed meat-product, the inside surface of the packaged product is the one which would have to be affected/influenced by corona/plasma treatment. Corona/plasma treatment involves bringing a film material into the proximity of a gas (e.g., ambient air) which has been ionized. Various forms of plasma treatment known to those of ordinary skill in the art can be used to corona treat an outer surface of a thermoplastic film material. Exemplary techniques are described in, for

example, U.S. Patent Nos. 4,120,716 (Bonet) and 4,879,430 (Hoffman), the disclosures of which are incorporated herein by reference. Regardless of whether or not the film of the present invention is corona treated, in one embodiment at least the inside (i.e., protein contact) layer thereof preferably has a surface energy of at least about 0.032 J/m^2 , more preferably at least about 0.034 J/m^2 , even more preferably at least about 0.036 J/m^2 , still more preferably at least about 0.038 J/m^2 , yet still more preferably at least about 0.040 J/m^2 , even further more preferably at least about 0.042 J/m^2 , and most preferably at least about 0.044 J/m^2 .

Various combinations of layers can be used in the formation of the multilayer films according to the invention. Given below are some examples of preferred combinations in which letters are used to represent film layers (Only some 2- through 6-layer embodiments are provided here for illustrative purposes; however, the multilayer films of the invention also can include more layers):

"A" represents a layer comprising EVOH, as described in the description of the first layer;

"B" represents a layer comprising at least one member selected from the group consisting of polyester, polyamide and polyurethane; preferably as described in the description of the second layer.

"C" represents a layer which comprises at least one member selected from the group consisting of polyolefin, polystyrene, polyamide, polyester and polyurethane, as described in the description of the third layer.

A/B, A/B/C, C/A/B, B/A/B, C/B/A/B, C/B/A/C, C/B/A/B/C, C/B/A/B/C/C', C/B/A/C/C', B/C/B/A/B/C.

Of course, one or more tie layers can be used in any of the above structures.

In any one of these multilayer structures, a plurality of layers (A), (B), and (C) may be formed of the same or different modified compositions and one or more tie-layers added.

The films of this invention are suitable for packaging a wide variety of meat-products using a wide variety of cooking conditions. Proper cooking has three principal functions: (a) to destroy or inhibit bacterial growth which causes spoilage of the products and thus reduces shelf-life; (b) to produce desirable color development; and (c) to impart

specific texture and flavor to the products. Cooking in the commercial processing of meat is done by hot air, hot water, or steam. In processing by hot air, the transfer of heat is usually slow and many of the processing schedules are related to the texture achieved in the finished product. An air cooking or smokehouse temperature of 77-80°C is used to
5 acquire a product internal temperature of 66-76°C. Water cooking is usually done in kettles or vats, in spray cabinets, or in steam cookers. Water cooking is more rapid than conventional air cooking. The temperatures of importance in meat processing are 52-54°C and 64°-67°C (147°-153°F). The water and salt soluble protein coagulate at 52°-54°C. Collagen shrinks at 63°-67°C. On continued heating at about 65°C or above, the collagen
10 converts into gelatin. In order to obtain an acceptable product, the protein matrix created during tumbling and massaging has to be cooked at the appropriate temperature and rate. The ability of the muscle to bind water and form a functioning gel in a comminuted animal tissue product is given by the inherent functional properties of the muscle proteins, mainly myosin. Myosin is the major protein that strengthens the bond between adjacent pieces of
15 meat in sectioned and formed products. However, to achieve this, it is believed that the package (film) needs to start shrinking to keep the "comminuted paste" together before the surface myosin has fully denatured. When a protein is denatured it loses its functional properties, in this case the ability of myosin to hold water and create good gel. On the other hand, in certain processed meat markets, it is also important to consider the
20 temperatures at which starch starts gelatinizing. Much of the processed-meat products produced in many parts of the world contain anywhere from 0 - 18% starch. The starch type varies, depending on the producer's preference, such that some will use potato starch and others pre-gelatinized starch or so called modified starches. In any case, as the temperature of the cookhouse is increased, the starch molecules vibrate more vigorously,
25 breaking intermolecular bonds and allowing their hydrogen-bonding sites to engage more water molecules. Usually, the higher amount of starch the higher the injection levels used. In general, starch begins to gelatinize anywhere from 59°-70°C depending on the type of starch. Modified starches can begin gelatinizing even earlier in the cooking process. Continued heating in the presence of abundant water results in the complete loss of
30 crystallinity, this is regarded as the gelatinization point or temperature. This usually occurs in a very narrow temperature range, for example for potato starch from about 62°-

68°C. During gelatinization granules swell extensively, hence the need for a packaging material with good elastic recovery - for starch containing cook-in products. In accordance with the present invention, it is believed that if the film is not shrinking properly around the packaged product (i.e., lack of elastic recovery, free shrink and shrink force) at a given temperature, the meat protein denatures and there is more "free" water for the starch to capture. As the starch becomes "oversaturated" with water and the temperature continues to rise, the starch granules become heavy and gravitational effects cause it to precipitate. This process (retrogradation) is accompanied by water exclusion which is called syneresis and results in purge or cook-out. By a judicious choice of resin selection and annealing conditions in accordance with the present invention, properties such as elastic recovery, free shrink and shrink tension can be controlled to provide films which are robust and work with a wide variety of cooking conditions and applications.

The cooking can be conducted in a supported environment (for e.g., in molds) as well as in an unsupported environment. The cooking cycle can be such that the temperature of the cooking chamber changes gradually as a function of time (referred to as step-cooking) or can be such that a relatively constant temperature is maintained in the cooking chamber. In typical step cooking cycles, the initial temperature can be as low as 50°C and the temperature of the chamber is then increased from 50°C up to about 85°C over time. Furthermore, cooking applications can include those wherein the package is slack filled with meat and then cooked in a mold or cooked unsupported. It can also include applications where the package is stuffed tightly with meat so that the radial circumference of the uncooked package is greater than the circumference of the layflat tubing/film used. The films of this invention are designed to work acceptably over a wide variety of cooking conditions and temperatures, as described above.

The film of the present invention can also be used to package a variety of products, although it can optimally be used to package proteinaceous food products, particularly meat products. Examples of meat types that can be packaged include, but are not limited to, poultry, pork, beef, lamb, fish, goat and horse. Examples of meat products that can be packaged include, but are not limited to, ham, bologna, braunschweiger, mortadella and head cheese. The meat-products can comprise a wide variety of additives, including water,

starch and other fillers. However, the films of this invention are particularly suitable for the packaging of poultry and pork products.

The following articles of manufacture can be used to yield the packaged product of the invention - a seamless casing, a backseamed casing, a bag or a pouch. A bag can be made from the film of the present invention by sealing to itself the meat-contact layers; whereby those layers becomes the inside layers of the bag. The bag can be an end-seal bag, a side-seal bag, an L-seal bag (i.e., sealed across the bottom and along one side with an open top), or a pouch (i.e., sealed on three sides with an open top). Additionally, lap seals can be employed.

The packaging just described can be done by first forming a bag from the film (as described immediately above), introducing the product into the bag, then sealing the open side of the bag. In another preferred embodiment, a seamless or backseamed casing can be clipped at one end, stuffed with meat product and then clipped or sealed at the other end to ensure a hermetic seal. Alternatively, the film of the present invention can be wrapped substantially completely around the product and then heat sealed so as to form a package. Where such a bag or package is made from a heat shrinkable film according to the present invention, the film can shrink around the product when it is subjected to heat. Where the product being packaged is a food product, it can be cooked by subjecting the entire bag or package to an elevated temperature for a time sufficient to effectuate the degree of cooking desired.

Regardless of the structure of the multilayer film of the present invention, one or more conventional packaging film additives can be included therein. Examples of additives that can be incorporated include, but are not limited to, antiblocking agents, antifogging agents, slip agents, colorants, flavorants, antimicrobial agents, meat preservatives, and the like. (The ordinarily skilled artisan is aware of numerous examples of each of the foregoing.) Where the multilayer film is to be processed at high speeds, inclusion of one or more antiblocking agents in and/or on one or both outer layers of the film structure can be preferred. Examples of useful antiblocking agents for certain applications are corn starch and ceramic microspheres.

In accordance with the present invention it has been found that in order to provide a packaged product with good inter-ply adhesion, good tightness and no/minimal cook-out,

the films have to possess a combination of features. These features include specific film compositions as described above in the detailed description of the invention. These preferred film compositions are believed to provide the films of this invention with certain advantages in terms of inter-ply adhesion, elastic recovery (which influences package tightness) and film-to-meat adhesion. Furthermore, it is believed that the films of this invention must have at least 3% transverse direction free shrink at 57°C in order to work effectively for a wide variety of cook-in applications. Moreover, it has been found that it is advantageous to have a film with a transverse direction shrink tension of at least about 0.3 MPa at 57°C. It has also been found that it is particularly beneficial to have films wherein the longitudinal direction shrink tension at 57°C and 80°C is from about 70-130% of the transverse direction shrink tension. Additionally, it is believed that the Young's modulus of the film and the cross-link density within the film (the latter influenced significantly by irradiation) play a key role in achieving package tightness and preventing cook-out. Also, film thickness is believed to also play a key role in achieving package tightness and minimizing cook-loss.

As described in the above descriptions, the films of this invention provide good inter-ply adhesion, tubing relatively free of wrinkles and creases, good package tightness and minimal cook-out with a wide variety of products, especially proteinaceous products, and especially meat products.

The examples of this invention, set forth below, indicate that in films which are annealed, it is extremely important to have good inter-ply adhesion; otherwise, the annealing process can exacerbate poor inter-ply adhesion. It is difficult to obtain satisfactory inter-ply adhesion as taught in the prior art by using a tie-layer directly adjacent to the EVOH. However, in accordance with the present invention, the use of a layer of polyamide directly adhered to the EVOH layer resolves the issue of inter-ply delamination in the film.

While the dynamics involved in producing an annealed, heat-shrinkable film are complex, it is believed that a variety of factors are responsible for resolving the problem of poor inter-ply adhesion. Firstly, the orientation dynamics of a structure with polyamide directly adhered to EVOH is believed to be different from that of a structure which has a tie layer directly adhered to EVOH. It is believed that the polyamide dominates the

annealing process, and also the orientation process such that it forces the EVOH to be oriented appropriately, without undergoing thinning. In other words, the polyamide carries the EVOH layer through the annealing process and the orientation process. Since the annealing process generates stresses in the film which cause it to shrink (or decrease in width), the polyamide layer has an important role. It is believed that a structure which has a layer of polyamide directly adhered to the EVOH is more robust in the annealing process and reduces or eliminates any tendency of the film to wrinkle or crease. The use of a polyamide directly adhered to EVOH also yields better inter-ply adhesion in the annealed film, which further makes the film less susceptible to inter-ply delamination. It also has been found in accordance with the present invention that films which have a layer of polyamide directly adhered to EVOH can be oriented at much higher total orientation ratios (as high as 10) while still providing annealed tubing which is relatively free of wrinkles, creases and inter-ply adhesion problems. A further comparison of the films of this invention with those of Comparative Examples 4 and 5, below, indicate that the layer of polyamide directly adhered to the layer of EVOH facilitates the deployment of a higher longitudinal racking ratio without delaminating (for example, the films of Example 1 and 2 deploy a LRR of about 3, as compared to the film of Comparative Example 5 which deploys a LRR of about 2.4 and still experiences poor inter-ply adhesion. These discoveries are particularly significant to films which are annealed, or can otherwise be described as being substantially shrink free in the transverse direction at 50°C because, in general, the lower the final TD shrink of the film, the higher the annealing temperature, and therefore, the greater the stresses generated on the film which induce it to delaminate and produce striations, wrinkles and creases.

The objects and advantages of this invention are illustrated by the following examples, which are provided for the purpose of representation, and are not to be construed as limiting the scope of the invention. The particular materials and amounts thereof, as well as other conditions and details, recited in these examples should not be used to unduly limit this invention. Unless stated otherwise, all percentages, parts, etc. are by weight.

EXAMPLES

Example 1

A coextruded multilayer film in the form of a tube was prepared. Film made from the tube had a structure as shown below (with the first layer being at the inside of the tube and the last layer being at the outside of the tube):

A / B / C / D / E / F / G / H / I / J

wherein

A was a 0.0064 mm (6.4 micron) outer layer made from SURLYN® 1650 ionomer of an ethylene/acrylic acid copolymer (E.I. DuPont de Nemours, of Wilmington, Delaware).

B was a 0.0025 mm (2.5 micron) layer made from TYMOR® 1203 anhydride-grafted LLDPE (Morton International; Chicago, Illinois).

C was a 0.0144 mm (14.4 micron) layer made from PE 5269T ethylene/vinyl acetate copolymer having a vinyl acetate mer content of 6.5% (Chevron Chemical Co.; Houston, Texas).

D was a 0.0042 mm (4.2 micron) layer made from TYMOR® 1203 anhydride-grafted LLDPE.

E was a 0.0042 mm (4.2 micron) layer made from a blend of 70% ULTRAMID™ B4, a polyamide 6, (BASF) and 30% GRILON™ CF6S, a polyamide 6/12 copolymer, (EMS American Grilon, Inc.; Sumter, SC).

F was a 0.0042 mm (4.2 micron) O₂-barrier layer made from EVAL® LC-E105A ethylene/vinyl alcohol copolymer (Eval Co. of America; Lisle, Illinois).

G was a 0.0050 mm (5 micron) layer made from a blend of 70% ULTRAMID™ B4 and 30% GRILON™ CF6S.

H was a 0.0042 mm (4.2 micron) layer made from TYMOR® 1203 anhydride-grafted LLDPE.

I was a 0.0127 mm (12.7 micron) layer made from DOWLEX™ 2244 LLDPE resin (Dow Chemical Co.; Midland, Michigan).

J was a 0.0072 mm (7.2 micron) layer made from a blend of 70% DOWLEX™ 2244 LLDPE, 10% FORTIFLEX® T60-500-119 high density polyethylene (Solvay

Polymers, Inc.; Deer Park, Texas) and 20% PRIMACOR™ 1410 ethylene/acrylic acid copolymer (Dow Chemical, Midland, Michigan).

Each of the layers was extruded separately between about 170°C and about 260°C through an annular die heated to approximately 215°C. The resultant coextruded
5 multilayer tube was cooled with water and flattened.

The tube was passed through an oscillating beam of an electronic crosslinking unit, where it received a total dosage of about 85 kGy. After irradiation, the flattened tape was passed through a hot water bath (held at a temperature of from about 90°C to about 99°C) for about thirty seconds. The heated tube was inflated into a bubble (thus orienting it) and
10 then cooled to lock in the molecular orientation. The orientation ratio before annealing - LRR times TRR (i.e. Longitudinal Racking ratio multiplied by Transverse Racking ratio) was about 8 (LRR of about 3 and TRR of about 2.7). The oriented tube was then annealed by bringing it into contact with a heated surface at approximately 55°C, whereupon the resultant film had a lay-flat width of about 19 cm and a total thickness of about 0.065 mm
15 (65 microns). The bubble was stable, and the optics and appearance of the film were good.

There were no signs of tubing striations or delamination induced wrinkles and creases, either in the annealed film or the film just prior to annealing. Furthermore, examination of the tubing under a microscope also showed good inter-ply adhesion between all the layers.

Several packages of clipped casings were made from the resulting tubing, filled
20 with two different types of an uncooked meat product. These packages were then step-cooked in a mold for 4-6 hours from an initial temperature of about 50°C to a final cook temperature of about 80°C. After cooking, the packages were cooled down to about room temperature and then examined for various attributes including package tightness, cook-out and actual extent of film-to-meat adhesion. The results are summarized in Tables
25 1&2. The film layer that contacted the meat product was the layer denoted as A above. The process of stripping the film from the cooked meat product did not leave residual film on the underlying product.

PCL XL error

Subsystem: KERNEL

Error: IllegalTag

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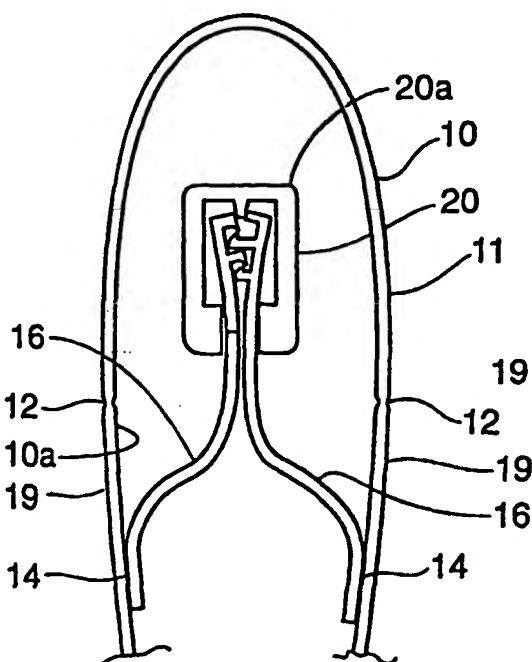
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(54) Title: A RESEALABLE BAG FOR FILLING WITH FOOD PRODUCT(S) AND METHOD



(57) Abstract: A reclosable bag (100) for filling with at least one food product. The reclosable bag generally includes at least one sheet of web material (10) having at least two areas of structural weakness (12). At least one fold structure (11) is located between and defined by the two areas of structural weakness. An opening (33) is located generally opposite the fold structure. The reclosable bag further includes a reclosable fastener structure having an integral skirt structure (16) of skirt web material, including a distal margin, extending therefrom. The distal margin is coupled to the web material at, at least one location between the areas of structural weakness and the opening. The reclosable fastener structure extends past the areas of structural weakness and into the fold structure. The reclosable bag is capable of being filled with at least one food product through the opening. Alternatively, the reclosable bag may include a gusseted portion (310) located generally opposite the fold structure and wherein the opening is located between the fold structure and the gusseted portion.

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**A RESEALABLE BAG FOR FILLING WITH FOOD
PRODUCT(S) AND METHOD**

This is a continuation-in-part patent application of U.S. Continuation-in-part Patent Application Serial No. 09/474,493 filed on 29 December 1999 which is a
5 continuation-in-part of U.S. Patent Application Serial No. 09/431,732 filed on 1 November 1999. These applications are now pending and not abandoned, and are commonly owned by the assignee hereof.

10 **Background of the Invention**

The present invention relates generally to the field of reclosable bags and more specifically to reclosable bags that use or incorporate tamper evident, hermetic seal, and reclosable fastener assemblies or
15 mechanisms of the slider, zipper, or press-to-close type. The present invention is particularly concerned with a reclosable bag that may be filled with a food product at a factory or food processing plant and then sealed to protect the food product until such time as a customer
20 purchases the reclosable bag and opens it to access the food product within.

Reclosable, typically flexible, containers are well known in the art. Such containers normally comprise a bag-like structure made from a folded web of material,
25 like thermoplastic film. These types of containers may

also include reclosable zipper structures, as well as interlocking male and female zipper elements fused, extruded, or attached to the bag sidewalls. Alternatively, the reclosable zipper structures, mechanisms, or assemblies may also be identified as slider closure systems, i.e., a closure system for slider bags and form, fill and seal technology that contain two tracks that can be interlocked and a separate part (a slider) that rides on the tracks and is used to open and/or close the tracks. The bag-like structure is created when the thermoplastic film is folded, sealed, and severed along its exposed edges.

Reclosable bags are a great convenience to the consumer. This is especially true where the food product or material contained within the bag is of a type that may not all be consumed at once, for example, shredded cheese, sliced cheese, cheese, processed cheese, deli meats, snack foods, vegetables, fruits, sweets, etc. A problem with these types of bags is achieving a design in which the food product is hermetically sealed against oxygen, atmospheric intrusion or transmission, bacteria, molds, and/or other sources of contamination, while also providing features that help to disclose to the consumer evidence of tampering without substantially interfering with the ease of use of the bag.

In addressing this problem it is also desired to achieve a design that is easy to manufacture and may be used in combination with known types of packaging machinery that use form, fill, and seal technology such as Horizontal Form Fill and Seal (HFFS) machines or Vertical Form Fill and Seal (VFFS) machines. It is also desired to achieve a design that may optionally be used in combination with Horizontal Flow Wrapper (HFW) machines; e.g., J-WRAP machines presently available from Jones Automation Company, Inc. of Beloit, Wisconsin.

Tamper evident packaging may also require the use of several pieces of film, which must then be connected to each other. This can make manufacturing of the reclosable bag more complicated.

5 Gusseted style packages are additionally greatly convenient to the consumer. Gusseted style packages allow the package to stand upright due to their wider base. This is true when it is desirable to stand a package upright by itself. Further, the wider base of
10 the gusseted style package enables them to hold a greater volume of product than a conventional four-sided seal package of similar dimensions. The challenge has been to combine the convenience of a zippered packaged in one gusseted, reclosable bag.

15 With a "press to close" type zipper, the gusset style package is typically formed with the gusset at the bottom and the zipper at the top. This type of package is filled through the opened zipper. Several problems have arisen during production and filling of this type
20 package. For example, in the package making process, it is necessary for the "press to close" zipper to be closed (i.e. the male and female profiles need to be engaged), when the zipper profiles are fused together at the side seal. If the male and female profiles are not engaged,
25 they are subject to misalignment. If they are misaligned at the side seal station, the resulting package will have a zipper that does not close completely, specifically adjacent to the side seal, and a leaky package results. Furthermore, after the side seal is
30 added, the usually simple process of opening the zipper for filling using a stationary blade to plow the zipper open, is no longer a reasonable option. Rather, the zipper must be opened, by either pulling the sides of the package that the zipper is attached to apart, or by
35 holding the sides securely while a plunger lowers into

the upper portion of the package, forcing the zipper open. Regardless of the method chosen, an unacceptable percentage of unopened packages or damaged zippers results.

5 An additional problem encountered by usual top
filling of the zippered, gusseted bag, is product waste
and contamination of zipper profiles. As a solution to
this problem, some filling processes lower a fill tube
10 into the package and past the zipper profiles area in an
attempt to protect the profiles from the product. This
technique reduces profile contamination, but does not
eliminate it. This is because clearance must be
maintained between the fill tube and the package walls to
ensure consistency of tube insertion and to provide an
15 exit passage for the air of the package that the product
is displacing. In the stream of air exiting the package
to make room for the product, some product is inevitably
included, and profile contamination results.

 A further problem associated with traditional top
20 filling of zippered, gusseted packages occurs when the
zipper is closed after the package has been filled with
product. The usual method forces the zipper closed by
applying force to both sides of the zipper and in a
direction tangent to the sides of the package. This
25 process may not consistently close the zipper and those
that do close may have product pushed into the zipper
profiles.

 Gusseted packages using a slider type zipper
encounter additional filling problems. In filling a
30 package of this type, the slider portion of the zipper
must be slid from one side of the package to the other in
order to open the profiles. Once the package is filled,
the sliding of the slider portion must be reversed to
close the top. This process is difficult and expensive,
35 rendering top filling through slider type zippered

packages to be commercially impractical.

5 The closest gusseted package references are believed to be U.S. Patent No. 5,938,337 issued on 17 August 1999, U.S. Patent No. 5,529,394 issued on 25 June 1996, and U.S. Patent No. 5,417,040 issued on 23 May 1995. Although these patents disclose advantageous methods, they fail to fully utilize the benefits of a gusseted type package. Namely, because of the wider base provided in a gusseted bag, they are able to hold a greater volume than conventional four sided seal packages of the same height and width. The above-mentioned patents provide methods for filling the gusseted bag from the gusset side of the package and opposite the closure mechanism. However, when a gusseted bag is filled from the bottom, 10 gusseted side, product stacks upward in the package similarly to filling a conventional four sided package. The result is the inability to fully utilize the added volume benefit that the gusset provides. 15

20 It is one of the objectives of the present invention to provide a reclosable bag that may be manufactured using known packaging machinery. As previously, noted, such known machinery includes HFFS machines, VFFS machines, and HFW machines. Additionally, as will be apparent to a person of skill in the art after reading the present disclosure contained herein thermoform type machines like the one disclosed in US Patent No. 4,240,241 could also be used to practice the present invention disclosed herein, after appropriate modification as the disclosure herein will make apparent. 25

30 It is also an objective to perform the manufacturing task using only one piece of parent film in combination with a reclosable zipper assembly.

Further, it is an objective of the invention to provide the manufacturer with the option of including 35 some or all the features of tamper resistance or

evidence, hermetic seal, and ease of use in the reclosable bag that is produced.

Another objective, especially with slider or zipper type structures or sliding type zippers or fasteners is ease of use. While a sliding type zipper structure is itself relatively easy to use, the bag structures include sidewalls or fin portions that extend up past the sliding type zipper structure. This interferes with the consumer's access to the food, makes it difficult to see the zipper structure, and also makes it more difficult to easily operate the zipper mechanism. This is especially true if the person opening and closing the bag is disabled, has arthritis, or another ailment, which limits the manual dexterity of that person.

Additionally, increased ease of access to the food product is an objective because the larger the zipper structure and its associated elements the smaller the opening left to the consumer to access the food product.

It is a further objective to provide a reclosable gusseted package that may be side filled with product.

It is another objective to provide a reclosable gusseted package that may be side filled and avoid zipper profile contamination.

It is another objective to provide a reclosable, gusseted package that may be side filled to ensure optimal volumetric filling of the gusseted portion.

It is one of the objectives of the present invention to provide a gusseted reclosable bag that may be manufactured using known packaging machinery, such known machinery includes HFFS machines.

The present invention is believed to address these and other objectives by the unique and simple structures and methods disclosed herein.

Summary of the Invention

The present invention may generally be described as

a reclosable bag for filling with at least one food product. The reclosable bag includes at least one sheet of web material. The sheet of web material has at least two areas of structural weakness and at least one fold structure located between and defined by the two areas of structural weakness. The reclosable bag includes an opening located generally opposite the fold structure. (Please note that fold structure as used in the specification and claims herein is to be interpreted as broadly as possible and should include not only structures that are a fold but also any structure that has the same or similar characteristics to a fold even though said structure may be formed by non-folding means or methods such as the result of joining or fusing the edges of two or more sheets of film.) In addition, the reclosable bag includes a sliding fastener structure having a skirt structure of web material extending therefrom and located within the fold structure. The skirt structure or skirt material may be either integral to the slider fastener structure or it may be coupled, e.g., sealed or adhered, to the slider fastener structure. The skirt structure includes a distal margin that is coupled to the sheet of web material at a location between the areas of structural weakness and the opening. The web material of the reclosable fastener structure extending past the areas of structural weakness so that the reclosable fastener structure is located within the fold structure. The reclosable bag is capable of being filled with at least one food product through the opening.

The reclosable bag structure of the present invention may optionally include other features. For example, but not by way of limitation, the skirt may include an outside surface and an inside surface. The distal margin is located on the outside surface. The

inside surface may include a predetermined area having a releasable adhesive material. This allows for the option of having a peelable seal, which may be used to aid in making the reclosable bag initially hermetic and may also
5 add another reclosable/resealable feature to the bag.
(Please note that the terms reclosable, resealable, and releasable, in addition to their normal meaning, are used herein, interchangeably, to describe a closed or sealed opening that may be re-opened at a predetermined time to
10 aid in providing access to at least a portion of the contents of the bag, and then closed or sealed to allow the remaining contents to be stored in the bag for later use and/or provide evidence of tampering.)

Additionally, and more typically, the web material
15 of the reclosable bag is substantially comprised of a predetermined portion of a roll of a parent film material. The predetermined portion having predetermined dimensions from which a reclosable bag of predetermined dimensions may be constructed. The parent film material
20 may be manufactured to a specification which determines the shape and location of the areas of structural weakness and which makes the areas of structural weakness an integral part of the parent film. Presently, it is believed to be commercially preferred to do so.
25 Alternatively, the areas of structural weakness could be applied to the parent film at a predetermined step of the construction or manufacturing process of the resealable bag.

Further, the areas of structural weakness may
30 extend intermittently, continuously, and linearly, non-linearly, or in some other predetermined pattern across a predetermined dimension of the sheet of web material. The predetermined dimension where the area of structural weakness is located may be either the length or the width
35 of the reclosable bag, which is usually rectangular in

shape, depending on whether or not it is desired to use the long edge or side of the bag or the short edge or side of the bag with the slider closure system. Use of the long edge of the bag provides for a larger opening and thus enhances the ease of access to the food material or other materials contained within the reclosable bag.

The term structural weakness is generally used to describe that area of the reclosable bag that is intentionally designed to be easily torn by the consumer to provide for evidence of tampering and to allow for easy exposure of the zipper mechanism or assembly. Nonetheless, it should be understood that use of the term structural weakness should include, without limiting its meaning, structures such as perforation, scores, microperforations, and multiple laminate materials which include a layer having an area of material or materials which are specifically designed to be easily torn. Accordingly, it should be understood that the areas of structural weakness are intentionally designed to create a predetermined tear path, which may or may not be hermetic.

Also, opening of the bag may be facilitated by the application of a tear strip (e.g., tear tape or tear string) along a predetermined surface or surfaces of the parent film. The tear strip may or may not be used in combination with a predetermined area of structural weakness.

Alternatively, the present invention may be described as a reclosable bag for filling with at least one food product and comprising at least one sheet of a web material. The sheet of web material includes a first area of structural weakness and a second area of structural weakness. (Alternatively, the areas of structural weakness may be tear areas or areas having a propensity to tear in a predetermined direction.) The

sheet of web material including at least one fold structure, located between and defined by the first and second areas of structural weakness, and a fill opening. The sheet of web material further comprising a first
5 panel coupled to the fold structure at the first area of structural weakness and a second panel coupled to the fold structure at the second area of structural weakness. A reclosable fastener structure including a male track structure and a female track structure. The male track
10 structure including a first fin structure of web material extending therefrom and the female track structure including a second fin structure of web material extending therefrom. Each fin structure including a predetermined coupling portion. The coupling portion of
15 the first fin structure being coupled to the first panel and the coupling portion of the second fin structure being coupled to the second panel. (please note that the seal, when it is formed, may be adjacent or near but should not be on the area of structural weakness). The
20 reclosable fastener structure extending past the areas of structural weakness and into the fold structure. The areas of structural weakness being located below the reclosable fastener structure. The alternative reclosable bags are also capable of being filled with at
25 least one food product through the fill opening, which is subsequently sealed.

The present invention allows the fold structure to be easily removed from the reclosable bag. More importantly the present invention allows the consumer to
30 substantially expose the reclosable fastener structure so that it is easily accessible and the consumer does not have to be impeded by bag sidewalls or bag fin portions that extend up past the zipper structure. Finally, the present invention accomplishes this using but not limited
35 to substantially one piece of film material.

Alternatively, the present invention may be described as a reclosable bag for filling with at least one food product. The reclosable bag may include at least one sheet of web material, at least one tear tape structure, at least one fold structure, and an opening located generally opposite the fold structure. A reclosable fastener structure including at least one integral skirt structure of skirt web material extending therefrom. The integral skirt structure including at least one distal margin. The distal margin being coupled to the web material at, at least one location between the tear tape structure and the opening. The reclosable fastener structure extending past the tear tape structure and into the fold structure. The reclosable bag capable of being filled with at least one food product.

Additionally, the reclosable bag for filling with at least one food product, may also be described as a reclosable bag including at least one sheet of web material having at least one fold structure presenting at least two sidewall structures having inside surfaces, and an opening located generally opposite the fold structure. A reclosable fastener structure including an integral skirt structure comprising a web material extending therefrom and including opposed distal margin structures. The web material of the integral skirt structure being sealed to the inside surfaces of the sidewall structures at a plurality of predetermined sealing areas. The reclosable bag may also include a barrier web material extending between and coupled to the distal margin structures.

The barrier web material of the alternative bag may alternatively extend between and be coupled to the sidewall structures. Alternatively, the barrier web material may also be coupled to predetermined sealing areas by at least one peelable seal. Alternatively, the

barrier web material may include at least one area of structural weakness that extends through it along a direction generally parallel to the predetermined sealing areas.

5 Alternatively, the reclosable bag for filling with at least one food product of the present invention may include at least one sheet of web material having at least one predetermined tear area, at least one fold structure, and an opening located generally opposite the
10 fold structure. A reclosable fastener structure including at least one integral skirt structure of skirt web material extending therefrom. The integral skirt structure including at least one distal margin. The distal margin being coupled to the web material at, at
15 least one location between the tear area and the opening. The reclosable fastener structure extending past the tear area and into the fold structure. The reclosable bag capable of being filled with at least one food product.

20 This alternative reclosable bag structure may further include at least one piece of a header material located in a predetermined area of the fold structure. The header material may include at least one edge structure adjacent the tear area. The reclosable bag of
25 this alternative structure may further include at least one tear tape structure coupled to the web material and adjacent to the tear area.

 Alternatively, the present invention may be described as a reclosable bag for filling with at least
30 one food product. The reclosable bag may include at least one sheet of web material, at least one tear tape structure, at least one fold structure, and an opening. A reclosable fastener structure including at least one integral skirt structure of skirt web material extending
35 therefrom. The integral skirt structure including at

least one distal margin. The distal margin being coupled to the web material at, at least one location between the tear tape structure and the opening. The reclosable fastener structure extending past the tear tape structure and around and over the fold structure. The reclosable bag capable of being filled with at least one food product.

Additionally, the reclosable bag for filling with at least one food product, may also be described as a reclosable bag including at least one sheet of web material having at least one fold structure, and an opening. A reclosable fastener structure including an integral skirt structure comprising a web material extending therefrom and including opposed distal margin structures. The web material of the integral skirt structure being sealed to the outside surfaces of the sidewall structures at a plurality of predetermined sealing areas. The inside surface of the reclosable bag may also include a predetermined area having a releasable adhesive material. This allows for the option of having a peelable seal, which may be used to aid in making the bag initially hermetic and may also add another reclosable/resealable feature to the bag.

Additionally, the present invention may be described as a method of construction using known form-fill-and-seal machinery including but not limited to HFFS, VFFS, and HFW machines. The steps of the method of construction include 1. Folding the sheet of web material along a predetermined folding area located between the areas of structural weakness to form the fold structure. 2. Inserting the reclosable fastener into the fold structure. 3. Coupling the distal margin of the integral skirt structure to the web material. 4. Sealing the web material along at least two predetermined linear areas located generally perpendicular to the fold

structure. 5. Filling the reclosable bag with at least one food product through an opening. 6. Sealing the opening. Please note that in an HFW application it is presently believed that the step four should occur last.

5 The method may also include a step of inserting either a tear tape or a tear string at least prior to step four. Further, a header strip could also be introduced prior to step four.

10 Alternatively, the web material may be slit along the fold line and the reclosable fastener assembly inserted and sealed to result in an exposed zipper structure assembly at one end of the bag.

15 Also, alternatively, if the reclosable bag is designed to have a gusset opposite the zipper opening then the fill opening may be sealed and the bag may be filled with product through the zipper opening.

20 Alternatively, the present invention may generally be described as a gusseted, reclosable bag for filling with at least one food product. The gusseted, reclosable bag includes at least one sheet of web material. The sheet of web material has at least two areas of structural weakness, a gusseted portion, at least one fold structure and an opening located generally between the fold structure and the gusseted portion.

25 In addition, the reclosable bag includes a sliding fastener structure having a skirt structure of web material extending therefrom. The skirt structure or skirt material may be either integral to the slider fastener structure or it may be coupled, e.g., sealed or
30 adhered, to the slider fastener structure. The skirt structure includes a distal margin that is coupled to the sheet of web material at a location between the fold and the opening. The reclosable bag is capable of being filled with at least one food product through a fill
35 opening located between the skirt structure and the

gusseted portion.

5 A backing or barrier strip structure is inserted between and extending below the zipper skirts along the side fill opening. The backing or barrier strip structure may be made out of any suitable material but is preferably two-ply and composed of a laminate film such as Curwood's 7182 barrier film. One side of the barrier strip structure to be used in the present invention is nylon, or any other suitable material such as
10 polypropylene, which will not bond to the parent film. The opposite side of the barrier strip structure may be provided with a sealant such as polyethylene, polyethylene blend, or a polyethylene co-extrusion. The sealant side is sealed or tacked to the inside surface of
15 the top (or front side) zipper skirt prior to insertion into an upper fold (i.e. fold structure). Once inserted into the upper fold, the front side of each zipper skirt is sealed to the parent film. The parent film then passes over folding boards to form a bottom gusset. The
20 remaining unsealed edge of parent film extends upward to meet the other edge located at zipper skirt. After filling with product, the final sealing bar seals the parent film to the zipper skirt and a portion of the barrier strip structure to make a hermetic package. With
25 the barrier strip structure inserted between and extending below the zipper skirts, the zipper skirts will not seal to each other and the nylon side of the barrier strip structure will not seal to the opposite inside surface of the parent film.

30 The gusseted, reclosable bag structure of the present invention may optionally include other features. For example, but not by way of limitation, the skirt may include an outside surface and an inside surface. The distal margin is located on the outside surface. The
35 inside surface may include a predetermined area having a

releasable adhesive material. This allows for the option of having a peelable seal, which may be used to aid in making the reclosable bag initially hermetic and may also add another reclosable/resealable feature to the bag.

5 Alternatively, if the reclosable bag is designed to have a gusset opposite the zipper opening, the bag may be filled with product through a fill opening located between the zipper skirt and the gusseted portion.

10 Alternatively, the present invention may be described as a gusseted, reclosable bag for side filling with at least one food product and comprising at least one sheet of a web material. The sheet of web material includes a first area of structural weakness and a second area of structural weakness. (Alternatively, the areas of
15 structural weakness may be tear areas or areas having a propensity to tear in a predetermined direction.) The sheet of web material including at least one fold structure, located between and defined by the first and second areas of structural weakness, a fill opening, a
20 backing or barrier strip structure, and a gusseted portion. A reclosable fastener structure including a male track structure and a female track structure. The male track structure including a first fin or skirt structure of web material extending therefrom and the
25 female track structure including a second fin or skirt structure of web material extending therefrom. Each fin structure including a predetermined coupling portion. (Please note that the seal, when it is formed, may be adjacent or near but should not be on the area of
30 structural weakness). The reclosable fastener structure extending past the areas of structural weakness and into the fold structure. The areas of structural weakness being located below the reclosable fastener structure.

35 The backing or barrier strip structure is inserted between and extending below the fin or skirt structures

along the side fill opening. As in the previous embodiment, one side of the barrier strip structure to be used is nylon, or any other suitable material such as polypropylene, which will not bond to the parent film.

5 The opposite side of the barrier strip structure may be provided with a sealant such as polyethylene, polyethylene blend, or a polyethylene co-extrusion. The sealant side of the backing or barrier strip of this alternative embodiment may be sealed or tacked to the

10 inside surface of the top (or front side) zipper skirt prior to insertion into an upper fold (i.e. fold structure). Once inserted into the upper fold, the front side of each zipper skirt is sealed to the parent film, as discussed with regard to the reclosable gusseted bag

15 with sliding fastener structure. Alternatively, an anti-seal agent may be brush applied to the inside surface of the zipper skirt prior to insertion into an upper fold.

Alternatively, the present invention may be described as a gusseted, reclosable bag for side filling

20 with at least one food product. The reclosable bag may include at least one sheet of web material, at least one fold structure, at least one gusset structure, a side fill opening having a backing or barrier strip structure, located generally between the fold structure and the

25 gusset structure. A reclosable fastener structure including at least one integral skirt structure of skirt web material extending therefrom. The integral skirt structure including at least one distal margin. The distal margin being coupled to the web material at, at

30 least one location between the fold structure and the opening. The reclosable bag capable of being filled with at least one food product.

This alternative reclosable bag structure may further include at least one piece of a header material

35 located in a predetermined area of the fold structure.

The header material may include at least one edge structure adjacent the tear area.

5 Additionally, the present invention may be described as a method of construction using known form-fill-and-seal machinery including but not limited to HFFS, VFFS, and HFW machines. The steps of the method of construction include 1. Placing a backing or barrier strip structure in registration with the side seal. 2. 10 Punching out the strip in the area that is both in the side seal and adjacent to the skirt of the zipper to which the backing or barrier strip will be attached. 3. Attaching the backing or barrier strip to the inside face of one of the skirts of a zipper track with sealant side of the strip facing the inside surface of the skirt. 4. 15 Heat sealing a portion of the remaining strip adjacent the zipper skirt to the zipper skirt. 5. Folding the sheet of web material along a predetermined folding area located between areas of structural weakness to form a fold structure. 6. Inserting the reclosable fastener and attached backing strip structure into the fold 20 structure. 7. Attaching the zipper track to the web in a location relative to the areas of structural weakness by heat sealing the web to the skirt portions of the zipper track. 8. Positioning the edge of the web such that it is attached to, but not covering the entire 25 portion of, the skirt having the barrier strip attached. 9. Passing the remaining web across folding boards such that a gusset is formed at the bottom of the package. 10. Folding the other edge of web material upward to the 30 remaining exposed zipper skirt having the backing or barrier strip attached, and adjacent to the first edge of the web. 11. Sealing the web material along at least two predetermined linear areas located generally perpendicular to the fold structure. 12. Filling the 35 reclosable bag with at least one food product through the

side opening. 13. Sealing the opening.

The method may also include a step of introducing a header strip prior to step ten.

Alternatively, the process and structure of the present invention could include a reclosable fastener assembly having two skirts or flaps of web material. The first skirt could be coupled or sealed to the parent film prior to folding the parent film. (Additionally, the first skirt could be tack or partially sealed prior to folding and then subsequently a full seal applied in the HFFS, VFFS, or HFW machine.) After folding the parent film the second skirt or flap would be sealed to the film sidewall located opposite the sidewall to which the first skirt is sealed or coupled. Construction of the bag could then be completed as disclosed herein.

Description of the Drawings

Figure 1 is a top plan view of a predetermined portion of parent film comprising a sheet of web material including at least two areas of structural weakness.

Figure 2 is an edge elevational view of a portion of the sheet of web material of Figure 1 and shows the location of the areas of structural weakness.

Figure 3 is a side elevational view of the fold structure of a reclosable bag of the present invention showing the position of the slider or zipper structure in the fold structure relative to the predetermined position of the areas of structural weakness.

Figure 4 is a perspective view of the embodiment shown in Figure 3.

Figure 5 is a front plan view of a first embodiment of the present invention.

Figure 6 is a front plan view of an alternative to the first embodiment of the present invention disclosing sealed track mass 23b.

Figure 7 is a front plan view of an alternative

embodiment of the present invention.

Figure 8 is a view taken from line 8--8 of Figures 5 and 6.

5 Figure 9 is an alternative to the embodiment of the present invention shown in Figure 8.

Figure 10 is another alternative to the embodiment shown in Figure 8.

10 Figure 11 is an alternative to the embodiment shown in Figure 10 wherein a peel seal tape with a releasable adhesive located on one side of the tape is used.

Figure 12 is a view from line 12--12 of Figure 11, the header material 15 that is shown, along with other structures, is optional.

15 Figure 13 is another alternative to the embodiment shown in Figure 8.

Figure 14 is a front plan view of another alternative embodiment of the present invention.

Figure 15 is a view taken from line 15--15 of Figure 14.

20 Figure 16 is an alternative to the embodiment of the present invention shown in Figure 15.

Figure 17 is another alternative to the embodiment shown in Figure 15.

25 Figure 18 is another alternative to the embodiment shown in Figure 15.

Figure 19 is a front plan view of an alternative embodiment of the present invention.

Figure 20 is a view from line 20--20 of Figure 19.

30 Figure 21 is a plan view of an alternative embodiment of the present invention illustrating various features of the invention including die cutting of the track mass of the zipper assembly and the use of a tear structure like a tear tape or a tear string.

Figure 22 is a view from line 22--22 of Figure 21.

35 Figure 23 is a view of an alternative to the

embodiment shown in Figure 22 wherein tear tape is applied to both the inside and outside surface of the bag.

5 Figure 24 is a cut-away view of an alternative to the embodiment shown in Figure 22 wherein the tear tape includes a tear bead.

Figure 25 is a perspective view of the embodiment shown in Figure 24.

10 Figure 26 is a cut-away view of a predetermined portion of the embodiment shown in Figure 24 illustrating the tear tape and tear bead's relationship to the film and the area of structural weakness created as a result of the presence of the tear bead.

15 Figure 27 is an alternative embodiment to the structure disclosed in Figure 22.

20 Figure 28 is a plan view of an alternative embodiment of the present invention illustrating various features of the invention including the use of an optional header strip and the use of an optional opening to assist in removal of the hood and exposure of the zipper assembly.

Figure 29 is a view from line 29--29 of Figure 28.

25 Figure 30 is a schematic diagram showing the components of another alternative embodiment of the present invention being fed into a machine suitable for adaptation to perform the process and make at least one of the products disclosed herein before the plow structure of the machine.

30 Figure 31 is a schematic diagram showing the components of another alternative embodiment of the present invention being fed into a machine suitable for adaptation to perform the process and make at least one of the products disclosed herein before the plow structure of the machine.

35 Figure 32 is a schematic top plan view illustrating

at least one method by which the components of the alternative embodiment disclosed in Figure 30 are introduced prior to the plow mechanism of the form fill and seal machine.

5 Figure 33 is a schematic top plan view illustrating at least one method by which the components of the alternative embodiment disclosed in Figure 31 are introduced prior to the plow mechanism of the form fill and seal machine.

10 Figure 34 is a perspective view generally showing the general relationship of the components for making the various embodiments disclosed herein. Specifically, the embodiment having the peel seal tape is disclosed although after review of this disclosure it will be
15 apparent to a person of ordinary skill in the art how the machinery may be modified to produce the various embodiments disclosed, described, and claimed herein.

 Figure 35 is side elevational schematic view illustrating the steps of construction of the alternative
20 embodiment disclosed in Figure 30 subsequent to folding the parent film on the plow structure.

 Figure 36 is side elevational schematic view illustrating the steps of construction of the alternative
25 embodiment disclosed in Figure 31 subsequent to folding the parent film on the plow structure.

 Figure 37 is an alternative embodiment of the present invention illustrating various features of the invention including the use of tear string and a diamond
30 shaped opening as opposed to a circular opening for assisting in the removal of the hood and exposing the zipper assembly.

 Figure 38 is a schematic diagram showing the components of another alternative embodiment of the present invention being fed into a machine suitable for
35 adaptation to perform the process and make the product

disclosed herein, wherein either a tear string or the zipper assembly are introduced to the parent film after the plow.

5 Figure 39 is a side elevational schematic view illustrating the steps of construction of the alternative embodiment disclosed in Figure 38 wherein the tear string or slider or zipper assembly is introduced after the plow structure.

10 Figure 40 is a front plan view of an alternative embodiment of the present invention.

Figure 40a is a front plan view of the alternative embodiment of Figure 40, but showing a peel seal area.

15 Figure 41 is a view taken from line 41 - 41 of Figure 40a and showing the reclosable fastener structure extending over the fold structure and peel seal.

20 Figure 41a is an enlarged view of the structure shown in Figure 41 and showing the position of the slider or zipper structure over the fold structure relative to the predetermined position of the areas of structural weakness.

Figure 42 is a front plan view of an alternative embodiment of the present invention.

25 Figure 43 is a view taken from line 43-43 of Figure 42 and showing a gusset portion, a slider fastener, and barrier strip and fill opening therebetween.

Figure 44 is a view similar to that shown in Figure 43 but with the gusset portion open and showing a flattened bottom.

30 Figure 45 is a side elevational view of the fold structure of the reclosable bag shown in Figures 42 - 44 showing the position of the slider or zipper structure in the fold structure relative to the barrier strip and fill opening, and showing side 36 in phantom in position for filling through side opening, and side 36 in solid line illustrating the closed opening after filling.

Figure 45a is a partially cut-away perspective view of the alternative embodiment shown in Figure 45.

5 Figure 46 is a schematic diagram illustrating at least one method by which the components of the alternative embodiment disclosed in Figures 42 - 45 are assembled.

10 Figure 47 is a schematic top plan view illustrating at least one method by which the components of the alternative embodiment disclosed in Figures 42-45 are introduced prior to the plow mechanism of the form fill and seal machine.

15 Figure 48 is a side elevational schematic view illustrating the steps of construction of the alternative embodiment disclosed in Figure 42-45 subsequent to folding the parent film on the plow structure and tucking board.

Figure 49 is a front plan view of an alternative embodiment of the present invention.

20 Figure 50 is a view taken from line 50-50 of Figure 49 and showing a gusset portion, press-to-close fastener with barrier strip, and fill opening between the gusset portion and fastener.

25 Figure 51 is a view similar to that shown in Figure 50 but with the gusset portion open and showing a flattened bottom.

30 Figure 52 is a side elevational view of the fold structure of the reclosable bag shown in Figures 49 - 51 showing the position of the press-to-close zipper structure in the fold structure relative to the barrier strip and fill opening, and showing side 36 in phantom while in position for filling through the fill opening and side 36 in solid line illustrating the closed and sealed, post-fill position.

35 Figure 53 is a schematic diagram illustrating at least one method by which the components of the

embodiment disclosed in Figures 49-52 are assembled.

Figure 54 is a schematic top plan view illustrating at least one method by which the components of the embodiment disclosed in Figures 49-52 are introduced prior to the plow mechanism of the form fill and seal machine.

Figure 54a is a cross sectional view taken along lines 54a-54a of Figure 54 and showing the press-to-close zipper structure and backing strip.

Figure 55 is a side elevational schematic view illustrating the steps of construction of the alternative embodiment disclosed in Figures 49-52 subsequent to folding the parent film on the plow structure and tucking board.

Figure 55a is an enlarged partial view of the area referred generally as 55a in Figure 55.

Figure 56 is a perspective view generally showing the general relationship of the components for making the gusseted embodiments shown in Figures 42-55a.

Figure 57 is a perspective view generally showing the relationship of the components for making a prior art gusseted bag.

Figure 58 is a perspective view of a prior art, top filled gusseted bag.

Figure 59 is a perspective view of a side fill gusseted bag of the present invention and showing a slider type zipper and a backing strip.

Detailed Description

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structures or methods. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is

defined by the claims.

The present invention is both a method and a structure resulting from the method. The present invention generally relates to reclosable plastic bags 100 and, more particularly, to a reclosable plastic bags 100 having a slider or zipper assembly 20, which cooperates with a tamper-evident feature. The tamper-evident feature may also be a hermetic seal feature. The method of the present invention, while unique and fully described herein, may be used on known machinery such as, by way of illustration and not by way of limitation, the rpm 100 packaging machine manufactured by Klockner Packaging Machinery of Sarasota, Florida, U.S.A. The modifications necessary to the machinery used to practice the present invention will be apparent to a person of ordinary skill in the art after reading this disclosure.

Reclosable plastic bags using various zippers and sealing mechanisms are well known. However, the advantages of the present invention are believed not to be apparent from the known zippers and sealing mechanism of the prior art. The zipper assembly 20 typically includes a zipper structure 20a and an integral skirt 16. In the present invention, the skirt 16 is bonded to the parent film 10 at a predetermined seal location 14. See Figure 3.

Referring to Figures 1-5, the method and structure of the present invention may begin to be generally described. Referring to Figure 1 a predetermined portion of the parent film 10 is illustrated. The parent film 10, at predetermined locations, is structurally weakened, e.g., by the use of presently known laser scoring technology.

Referring to Figure 2, an elevational edge view of the parent film 10 including the score lines 12 may be seen. The weakened area 12 may also be imperforate and

hermetic. The weakened areas 12 define an integral tear off portion or fold structure 11.

Referring to Figure 3, the film 10 is folded over, as shown, to form the fold structure 11 and a zipper assembly 20 is inserted. Weakened areas 12 are preferably positioned below the zipper structure 20a so that when fold structure or hood 11 is removed the zipper structure 20a is exposed sufficiently above the resulting fin structures 19 to allow the user access to the zipper structure 20a. Zipper skirts 16 are shown bonded to the film 10. However, it is presently believed preferable, prior to insertion of the zipper assembly 20, that the uncut ends 23 (see Figure 5) of each zipper assembly 20 be punched out or cut to form a radiused notch 22a, as shown in Figure 7. The cut zipper assembly ends 22 are sealed together (the sealed mass 22b of Figure 7) which will later function to retain the contents of the bag 100 such as food.

Referring back to Figure 3, the skirt(s) 16 remain intact so that the zipper assembly 20 is kept continuous for ease of handling. Once inserted the skirt(s) 16 of the zipper assembly 20 is bonded to the inside surface 10a of the parent film 10 at seal location(s) 14.

Next sides 30 and 32 are sealed, along margin 10c illustrated in Figures 5 or 7, using a known mechanism such as a heat-sealing bar of a form fill and seal machine by advancing the folded film 10 to the heat sealing bar portion of the machine used; creating a seal 30a across the length and width of margin 10c. The resulting bag 100 is then filled with a predetermined foodstuff or other desired material through the opening 33 located, opposite the zipper assembly 20, at bottom edge 34 shown in Figure 5 or 7. Then bottom edge 34 is subsequently sealed, forming seal 34a.

This results in the zipper assembly 20 being

hermetically sealed within the tear off portion 11. Tear off portion 11 is integral to the parent film 10. Integral tear off portion 11 may be easily removed by tearing along the score lines 12, leaving the zipper structure 20a fully exposed and easily accessible for the use desired.

The above noted process and mechanism may also be performed so that the zipper assembly 20 is located along one of the long sides 30 or 32 of the bag 100 rather than the short side of the rectangle, which is defined by the bag 100.

Referring to Figure 5, a second embodiment of the present invention 1 is illustrated. As may be seen from Figure 5 two bags 100 are shown prior to their being separated along seam 101. This embodiment includes score lines 12 laid out in an alternative pattern that includes curve or arcuate section 13 and tear notch 24. As further disclosed in Figure 7 the parent film 10 is sealed at section 26 to either its opposing sides 35 and 36 or the structure of the zipper assembly 20. The tear notch 24 provides a starting point for removing the fold structure 11, which is located above the zipper assembly 20. The fold structure 11 being defined by the location of the score lines 12. The score lines 12 extending along curve 13 to a predetermined area below the zipper assembly 20 for substantially the entire width of the reclosable bag 100 facilitating removal of the hood or fold structure 11 and exposure of the zipper structure 20a. The embodiment of Figure 5 further including a hermetic seal 40.

Referring now to Figure 8, a cross-sectional view of the embodiment of Figure 7 may be seen. In particular, the integral skirt 16, usually comprised of two strips on pieces of plastic film or a one-piece unit of continuous film, may be seen to have its outside

surface 19 sealed hermetically to the inside surfaces 36a and 35a at respective hermetic seals 40a and 40. Additionally, a peelable seal 50 is located at the bottom of the skirt 16. Any standard commercially known resealable adhesive 51 may be used to make the peel seal 50. The peel seal 50 may also be a hermetic seal 40b.

Referring now to Figure 9 an alternative to the embodiment of Figure 8 is shown. In this embodiment the zipper skirt 16 is heat sealed to the side panels 36 and 35 respectively of the parent film 10. The inside surfaces 17 of the zipper skirt 16 are peelable sealed to one another, using a known releasable adhesive 51, to provide a releasable hermetic or gas tight seal 50 therebetween. It should be noted that the terms resealable adhesive or releasable adhesive as used herein should be construed interchangeably as well as given their common meaning.

Referring now to Figure 10 another alternative embodiment of Figure 8 is shown. In this embodiment the parent film 10 is sealed along a predetermined portion 42 of inside surface 35a and 36a. A known releasable adhesive 51 is used to form a peelable seal 50 between inside surfaces 35a and 36a at predetermined portion 42. US Patent No. 4,944,409 contains an example of such an adhesive. Presently, CUREX brand grade 4482-0, supplied by Curwood of Oshkosh, Wisconsin is considered an acceptable adhesive for use with this embodiment of the present invention.

Referring now to Figures 11 and 12 another alternative embodiment is illustrated wherein the peelable seal 50 is comprised of a peel seal tape 53 having a permanent sealant like a metallocene catalyzed polyethylene located on one side and a releasable seal material like the aforesaid CUREX brand material on the other side (side 54).

One possible method for achieving the structure of Figure 11 and 12 is the use of a form fill and seal machine system in which the peel seal tape 53 would be tacked onto a predetermined location of the parent film 10 prior to the plow 200. (See Figures 31, 33, and 34 for a general illustration of the location of the plow 200 in relationship to the other components of a form fill and seal machine. Please note with reference to Figure 33 that it is presently believed preferable for heat sealer bar 208 to be enlarged sufficiently so that in addition to sealing the tear tape 120 is place it also seals the permanent seal side of the peel seal tape 53 in place at the same time. Accordingly, while one sealer bar 208 is believed preferable for these separate functions multiple bars could be used, each having a dedicated function or a combination of functions). After the plow 200 the peelable sealant side 54 would be sealed to the parent film 10 by heat sealer bars 55. Use of sealer bars 208 and 55 as disclosed herein allows independent temperatures and pressures to be used for each seal and it is believed that more consistent peel seals will result.

Additionally, the zipper skirt 16 may be sealed in place subsequent to the plow 200 by sealer bar 56 and the header seal 206a may be made by sealer bar 57 as illustrated generally in Figures 34 and 36.

Referring now to Figure 13 another alternative embodiment of Figure 10 is shown. In this embodiment, the zipper skirt 16 includes an elongated section 16a. End 21 of elongated section 16a is positioned between the inside surfaces 36a and 35a of the side panels 36 and 35 of the parent film 10. The elongated section 16a is heat sealed to the parent film 10 on inside surface 35a and peelable sealed using a known releasable adhesive 51 to inside surface 36a to form peel seal 50.

Referring now to Figure 14 a third embodiment of the present invention is disclosed. Again, two bags 100 are shown prior to their being separated along seam 101.

5 The invention of the third embodiment is comprised of parent film 10, which is used to form the bag 100 that is to be filled. The bag 100 includes a first side seal 30, a second side seal 32, and a fill opening 33. Side panel 35 forms the front side of the bag 100. The fill opening 33, after the bag 100 is formed and filled with a predetermined type of food material, is heat sealed to form bottom edge or seal 34. The bag 100 further includes a fold structure 11, header 15, integral zipper skirt 16, a zipper assembly 20 including a zipper structure 20a, at least one hermetic seal 40, an unsealed area 60, and a section 62 where the zipper skirt 16 and the ends 23 of the zipper assembly 20 are heat sealed together (see sealed mass 23b in Figure 14) prior to their insertion between the front side 35 and the back side 36 of the film 10. This forms sealed mass 23b. The formation of sealed mass 23b may take place at sealer 216, which is illustrated in Figure 30.

20 Sealing zipper skirt(s) 16 to the parent film 10 forms the hermetic or gas tight seal 40. The zipper skirts 16 may have a predetermined portion or portions that extend past seal 40 and which may be held together with a peel seal 50. See for example, Figure 15.

25 Since, within the unsealed area 60, the side panels 35 and 36 are not attached to the zipper assembly 20, the hood structure 11 (which may be defined by the score lines 12) may be easily removed to expose zipper structure 20a. The sealed mass 23b provides for containment of product when the peelable seal 50 is opened.

30 Referring to Figure 15 a view from line 15--15 of Figure 14 may be seen. This may be seen to be identical

to the embodiment of Figure 8, except as explained above with reference to Figure 14.

Referring now to Figure 16 an alternative structure to the one shown in Figure 15 may be seen. In this alternative, the zipper skirt 16 is made of one piece of material. It is heat sealed to the inside surfaces 35a and 36a to form hermetic seals 40 and 40a. The skirt 16 is provided with a structural weakness 45 which extends linearly and generally parallel to hermetic seals 40 and 40a along the zipper skirt 16. The structural weakness 45 is designed to fracture or tear relatively easily when the customer opens the bag 100.

Referring now to Figure 17, an alternative to the embodiment shown in Figure 16 may be seen. In this embodiment the zipper skirt 16 includes a barrier film section 16b. The barrier film 16b is applied (preferably by heat sealing although other methods could be used, e.g., Adhesive coupling, ultrasonic or high frequency sealing technology) to the inside surface 16d of the zipper skirt 16. The zipper skirt 16 is heat sealed along a predetermined portion of its outside surface 16e to parent film 10 to form a hermetic seal 40. The barrier film section 16b is releasably sealed to the inside surface 16d to form at least one peel type seal 50. Note that it is presently believed that section 16b must have a surface 16c that is resistant to heat sealing.

Referring now to Figure 18 an alternative to the embodiment shown in Figure 17 may be seen. In this embodiment barrier film section 16b is heat sealed to a separate predetermined portion of the inside surfaces 35a and 36a of the parent film 10. To form two additional hermetic seals 40 located below the hermetic seals 40 of the zipper skirt 16. The barrier film 16b is provided with a structural weakness at 45 which extends linearly

and generally parallel to hermetic seals 40. The structural weakness is designed to fracture or tear relatively easily when the customer opens the bag 100.

5 Alternatively, the structure of Figure 17 could be provided with a structural weakness 45 as described with reference to Figure 18. In such a case peel seal 50 would be replaced with a permanent seal.

Referring to Figures 19 and 20, header strip 206, located between the front side 35 and back side 36 of the parent film material 10, of a predetermined size have
10 sufficient width to extend down to, preferably just above, a tear line 132 (area of structural weakness). The header strip 206 terminates at edge(s) 131. This tear line 132 has the predetermined propensity to tear in
15 predetermined way. The extension of the header strip material 206 extends down so that it is adjacent to the tear line 132. This facilitates tearing off the hood structure 11 from the bag 100 along the tear line 132.

The optional tear notch 134 facilitates initiation of the tear, the tear line 132 (the oriented parent film 10 or film 10 with the propensity to tear) directs the tear, and the header material 206, which is bonded or sealed to the front side 35 and back side 36 of the parent film 10, controls the tear so that the zipper structure 20a is
20 consistently clear of the parent film material 10 after the removal of the hood structure 11.

Alternatively, if the header material 206 is made of an oriented polypropylene having at least one side with a heat sealable sealant then the parent film 10
30 would not need to be oriented or have the tear line 132 or propensity to tear. Presently, it is believed preferable that if the header material 206 is made of an oriented polypropylene then the oriented polypropylene should have both its sides coated with a heat sealable sealant. Also, alternatively, a plurality of header
35

strips 206 could be used instead of a single integral header strip 206. In either case, the parent film 10 would not necessarily need to be oriented or have a tear line 132 or a propensity to tear.

5 Referring to Figures 21 and 22, at least one but preferably two pieces of tear tape 120, located between the front side 35 and back side 36 of the parent film material 10 on film surfaces 35a and 36a, of a predetermined size are bonded or sealed to the parent
10 film 10 of the hood structure 11 adjacent, preferably just above, a tear line 132 (area of structural weakness). This tear line 132 has the predetermined propensity to tear in predetermined way. The tear tape material 120 adjacent the tear line 132 facilitates
15 tearing off the hood structure 11 from the bag 100 along the tear line 132 in a controlled manner. The optional tear notch 134 facilitates initiation of the tear, the tear line 132 (the oriented parent film or film with the propensity to tear) directs the tear, and the tear tape
20 120, which is bonded or sealed to the front side 35 and back side 36 of the parent film 10, controls the tear so that the zipper structure 20a is consistently clear of the parent film material 10 after the removal of the hood structure 11. Alternatively, if the tear tape material
25 120 is made of an oriented polypropylene having at least one side with a heat sealable sealant then the parent film 10 would not necessarily need to be oriented or have the tear line 132 or propensity to tear.

30 With respect to facilitating removal of hood or fold 11 it should be understood that instead of score lines 12 the parent film 10 may be weakened in predetermined areas using other procedures as well, including but not limited to scoring or the use of multiply laminate film having a predetermined weakened area or
35 the addition of a tear assistance structure, e.g., Tear

tape 120 or tear string 120a. The tear assistance structure may be added for use by itself or in conjunction with a predetermined area of structural weakness 12 to aid in the tearing of the film 10. See
5 Figures 28 and 29.

Referring to Figure 23 another alternative to the embodiment disclosed in Figure 22 is disclosed. In this embodiment tear tape 120 is applied to both the inside
10 surfaces 36a and 35a and the outside surfaces 36 and 35 of the bag 100. In this embodiment no score line or weakening 132 is believed necessary (although such an area of structural weakness could be used) since the tear tape 120 located on both the inside and outside surfaces of the bag 100 will act as an effective tear guide.

15 Referring to Figures 24, 25, and 26 another alternative to the embodiment shown in Figure 22 is illustrated. In this embodiment a modified tear tape 120b having a tear bead 120c is used.

As Figures 24-26 illustrate, when the film 10 is
20 sealed to the tear tape 120b the bead 120c is depressed into the film 10 creating an area of structural weakness 12 without requiring pre-scoring or other modification of the parent film 10 prior to the application of the tear tape 120b. This structure is believed beneficial because
25 the tear tape 120b is always in alignment with the area of structural weakness 12.

Referring to Figure 27 another alternative to the embodiment disclosed in Figure 22 is disclosed. In this
30 embodiment tear tape 120 is applied to both the inside surfaces 36a and 35a and the outside surfaces 36 and 35 of the bag 100. The tear tape 120 is applied to border both sides of the score line or weakening 132. Since the tear tape 120 is located on both sides of the score line 132 and on the inside and outside surfaces of the bag 100
35 a very consistent controlled or guided will be achieved.

5 Tear tape 120 is interchangeable with tear string 120a. Accordingly, a tear string 120a could be substituted for the tear tape 120. See, e.g., Figures 38 and 39. Preferably, the tear tape 120 or the tear string 120a used is made from a material, e.g., Thermoplastic material, that is compatible with the film 10 and which may be sealed, coupled, or bonded to the film 10. For example, the tear tape 120 or tear string 120a may be formed of polyethylene or may be encased in polyethylene. 10 It is understood in the art that a tear string, such as tear string 120a, may have various cross-sectional shapes, e.g., Round, square, triangular, etc., which may be used to enhance its ability to tear the parent film material 10.

15 In particular, referring to Figures 30, 32, and 35, the process by which the alternative embodiment having tear tape 120 is presently believed to be manufacturable is illustrated using an rpm 100 machine. The parent film 10 is fed over a predetermined number of rollers and toward the plow structure 200. The parent film 10 after 20 passing over dancer roller 203a is die punched by die 210 to present parallel openings 121. It is presently believed that the film 10 must pass over the dancer rollers 203a so that they are kept sufficiently taut thus allowing openings 121 to be punched out accurately at 25 predetermined positions, by die 210, such that the positions of the openings 121 are always at the same or a uniform distance from each other. In addition to the parent film 10 two rolls of tear tape 120 are fed over 30 the parent film 10 and in parallel alignment with the parallel openings 121 such that the tear tape 120 preferably, but not necessarily, bisects each the parallel opening 121. Tear string 120a could be substituted for tear tape 120. See, e.g., Figures 38 and 35 39.

In addition, referring back to Figures 30, 32, and 35, optionally a header material 206 may be fed over the parent film 10. Further, the zipper or slider assembly 20 is also fed over the parent film 10. Prior to being fed over the parent film 10 the zipper assembly 20 has a notch 22a die punched, by die 214 and heat sealed by sealer 216, at a predetermined position that is also designed to be in general alignment with the parallel openings 121. Once the tear tape 120 is presented over the parent film 10 but before it is passed over the plow 200 it passes over a tear tape sealer mechanism 208 so that the tear tape 120 is sealed to the parent film 10. Alternatively, the tear tape 120 could be tacked in place and subsequently sealed to the parent film 10 either before or after the plow 200.

The parallel openings 121 may be of any shape although circular is the shape that is presently preferred. Diamond shaped cuts could be used to further enhance initiation of the tear in the parent film 10. See Figure 37.

Additionally, the notch 22a as generally illustrated herein may be of an arcuate or radiused shape but the notch 22a could also be made at a sharp angle such as a 90° angle. See Figure 37. The sharper angle is presently believed to add more stress to the structure of the zipper assembly 20 and therefore a radiused structure is presently considered to be preferred. However, the present invention should not be interpreted as being limited to solely a radiused notch 22a as generally illustrated herein.

After the parent film 10 is folded the remaining manufacturing process is carried out as generally illustrated in Figure 35. The zipper skirts 16 are sealed to the respective sides of the parent film 10 at seal 14. The header strip 206, if used, is sealed to the

parent film 10 at seal 206a. The side seal 30a is made, which also seals the perimeter or edge 121a of opening 121. (note, if no tear tape 120 or tear string 120a is used then it is presently considered best to add a tear notch 24 to the opening 121 to facilitate removal of the hood 11.) An opening 123 is die punched in the package 100 to provide a point where the package 100 may be easily hung for display purposes. The package 100 is then cut along seam 101 from the V-fold portion of the form fill and seal machine and transferred to the fill and seal stations where fill opening 33 is opened and the package 100 is filled and gas is flushed through the fill opening 33. Opening 33 is then hermetically sealed at seal 34a.

Alternatively, referring to Figure 38 and Figure 39 the zipper assembly 20 may be introduced subsequent to the plow structure 200. The parent film 10, prior to being fed over the rollers 202 is still die punched by die 210 to present parallel openings 121. Also, alternatively, the tear tape 120 or tear string 120a may be feed over the parent film 10 and in parallel alignment with the parallel openings 121 subsequent to the plow 200. See Figures 38 and 39. Again, the tear tape 120 or tear string 120a preferably, but not necessarily, bisects each parallel opening 121. Also, while Figure 39 shows both the tear string 120a and skirts 16 of the zipper assembly 20 being introduced to the parent film 10 subsequent to the plow 200 and respectively sealed by sealer bars 208 and 209 it should be understood that either the tear string 120a or the zipper assembly 20 could be introduced before the plow 200. For example, the zipper assembly 20 could be introduced after the plow 200 and the tear string 120a prior to the plow 200. Since tear tape 120 is interchangeable with the tear string 120a it will be apparent to a person of ordinary

skill in the art reading this disclosure that the tear tape 120 could also be introduced after the plow 200 and used in essentially the same manner as the tear string 120a.

5 The openings 121 are provided, at a minimum, to facilitate access to the tear tape 120 or the tear string 120a and to facilitate tearing and removal of the hood 11 to expose the zipper assembly 20.

10 Additionally, the present invention may be used in combination with other VFFS and HFFS machines. The present invention could also be used with HFW machines. However, in using either VFFS machines or HFFS machines the method of the present invention is presently believed to require post-compression (commonly called post-squashing) of a predetermined portion of the track structures 20b, with respect to the embodiment shown in Figure 6. (sometimes also referred to as track mass 20b, herein) of the slider closure assembly 20 located within a margin or line 10b of the parent film 10 where a seal 20 30a, especially a hermetic seal, is desired. Alternatively, the track mass 20b may have a pre-compressed portion located with margin 10b. Neither pre-compression nor post-compression are believed to be required where a notch, e.g., 22a of Figure 7, has been 25 punched out or cut from the zipper assembly 20. However, if pre-compression is desired then this is accomplished in the present invention at sealer 216 shown in Figure 30. This is so that when, on either a HFFS or VFFS machine, the track mass 20b (with the slider or zipper 30 structure 20a avoided) passes through the package side seal zone portion of either the machine a consistent hermetic seal 30a is produced by the application of the heater bars of the machine used. As will be apparent to a person of ordinary skill in the art from this 35 disclosure, if a notch, e.g., notch 22a of Figure 7, is

cut from the zipper assembly 20 then there is no structure or mass for sealer 216 to pre-compress and sealer 216 will then only provide seal 22b of the cut end 22, as shown in Figure 7.

5 In applications using HFW machines for the manufacture of the embodiment shown in Figure 5, such as Jones Automation Company machines, it is not believed necessary to pre-compress, post-compress, or squash a predetermined portion of the track mass 20b. HFW
10 machines have a rotary jaw assembly, which includes a hinged side. The jaw assembly provides at least two advantages, either of which, separately or in combination, eliminates the need for pre-compression of the track mass 20b. First, the jaw assembly provides a
15 relatively long time, longer than the time provided by either VFFS or HFFS machines, for the application of heat and pressure sufficient to form the desired seal 30a. Second, the portion of the track mass 20b that is targeted to be fused or sealed (generally located within
20 the boundary of margin 10b) is placed or fed into the jaw assembly so that it is placed toward and near the hinged portion of the jaw assembly and thus maximum mechanical advantage and force may be applied to the predetermined portion of the track mass 20b.

25 If either the longer seal time or the mechanical advantage of the jaw assembly of the HFW machine was not available then, referring to Figure 6, since there is generally insufficient room on an HFW machine to pre-compress the track mass 20b, the track mass 20b may be
30 pre-punched with a die at the predetermined location 22a (where the seal 30a is also to be applied or created) prior to insertion into the fold 11 of the parent film 10. Since the pre-punched area or notch 22a would be synchronized to be in registration with the portion of
35 the folded parent film 10 that is to be sealed, less

energy (time, temperature, and/or pressure), due to the reduced mass to be sealed is required to consistently obtain the type of seal 30a desired. (note, pre-punching rather than pre-compression could also be used with HFFS or VFFS machines.)

5 Referring now to Figures 40, 40a, 41 and 41a, an alternate embodiment of the present invention may be seen. The film 10 is folded over, as shown, to form the fold structure 11, and a zipper assembly 20 is positioned over the fold structure 11. Weakened areas 12 are preferably positioned below the zipper structure 20a, so that when the zipper structure 20a is in the open position the fold structure 11 and its weakened areas 12 are exposed to allow the user access to the fold structure 11. Seen particularly in Figure 41, the overlaying zipper skirt 16, of the alternate embodiment may be viewed. Zipper skirt 16 is usually comprised of two strips of pieces of plastic film or a one-piece unit of continuous film, and is seen to have its inside surfaces 17 sealed hermetically to the outside surfaces 35b, 36b of the film 10 at respective hermetic seals 40c, 40d. The fold structure 11 is preferably designed to act as an imperforate hermetic barrier to protect the contents of bag 100. Tearing the fold structure 11 allows the user access to the contents and also provides visual evidence that the hermetic seal is broken. Seen particularly in Figures 40a and 41, the inside surfaces 35a, 36a of the parent film 10 may also be peelably sealed to one another, using a known releasable adhesive 51, to provide a releasable hermetic or gas tight seal 50 therebetween. The seal 50 is located adjacent, preferably just below, the weakened areas 12.

As best seen in Figures 40 and 40a, two bags 100 are shown prior to their being separated along seam 101. The alternate embodiment seen in these views is comprised of

parent film 10, which is used to form the bag 100 to be filled. The bag 100 further includes a header 15, and a peg hole 15a, seen in this embodiment at the end opposite the fold 11. It is presently believed preferable, after
5 the folding and sealing of parent film 10 that the parent film 10 be punched out to form a tear area 24a. The parent film is then sealed around the perimeter of the punched out tear area 24a and a tear notch 24 is added, as seen in Figure 40. These steps are preferably
10 performed before the attachment of the zipper assembly 20 and zipper skirt(s) 16. Following this, the zipper assembly 20 is positioned and bonded to the outside surfaces 35b, 36b, of the parent film 10, and over the fold 11. Alternately, the parent film 10 may be sealed
15 around the perimeter to include the sealed perimeter of the punched out tear area 24a so that after the punching step which forms tear area 24a, the sealed perimeter remains. The tear notch 24 provides a starting point for removing the fold structure 11, which is surrounded by
20 the zipper assembly 20 and attached zipper skirt 16. Further, at least one piece of tear tape 120, located between the front side 35 and back side 36 of the parent film 10 on film surfaces 35a, 36a, of a predetermined size may be bonded or sealed to the parent film 10 at the
25 fold 11. The tear tape 120 is located adjacent, preferably just above, a tear line 132 (area of structural weakness). This tear line 132 has the predetermined propensity to tear in a predetermined way. The tear tape material 120 adjacent the tear line 132
30 facilitates tearing off the fold structure 11 from the bag 100. The aforementioned tear notch 24 facilitated initiation of the tear.

Referring to Figures 41 and 41a, the skirt(s) 16 remain intact so that the zipper assembly 20 is kept
35 continuous for ease of handling. Once positioned over

the punched fold structure 11, the skirt(s) 16 of the zipper assembly 20 is bonded to the outside surfaces 35b, 36b of the parent film 10 at seal location(s) 40c, 40d. Next, sides 30 and 32 are sealed, along margin 10c illustrated in Figure 40, using a known mechanism such as a heatsealing bar of a form fill and seal machine (as described earlier in the present application) by advancing the film 10 to the heat sealing bar portion of the machine to be used.

It will be apparent to the person of ordinary skill in the art after reading this disclosure that the present alternative embodiment shown in Figures 40, 40a, and 41, 41a may be manufactured using the methodology previously disclosed herein with the necessary modifications, which this specification makes apparent to a person of skill in the art.

With reference to Figures 42 - 45a, an alternative embodiment reclosable bag 100' including a gusseted portion 310 and side fill opening 300 is shown.

The gusseted, reclosable bag 100' includes at least one sheet of web material 10 having at least two areas of structural weakness 12. The areas of structural weakness 12 may be micro perforations, scoring or any other structural weakness that will allow facile tearing of the web material 10. The weakened areas 12 define an integral tear off portion or fold structure 11. The gusseted, reclosable bag 100' is further defined by a gusseted portion 310 and a sealable fill opening 300. The sealable fill opening 300 is located generally between the fold structure 11 and gusseted portion 310.

A backing or barrier strip 320 is inserted between the zipper skirts 16. The backing or barrier strip 320 is preferably two-ply material and may be composed of laminent film such as Curwood's 7182 barrier film. A first or inner side 328, may be composed of Nylon,

polypropylene, or any other suitable material that will not bond to the parent film 10 during sealing. A second or outer side 329 of the strip 320 may be provided with a sealant, such as a polyethylene, polyethylene blend, or a polyethylene co-extrusion. The backing or barrier strip 320 is preferably notched at 326 and 326a (best seen in Figure 47) to allow proper sealing of side seal 30a. A zipper assembly 20 having attached zipper skirts 16 is inserted in the fold structure 11. When the zipper assembly 20 and skirt(s) 16 are bonded to the inside surface 36a of parent film 10 at 14, the inner resistant side 328 of strip 320 prevents the skirt(s) 16 from sealing together along their respective inner surface 17, seen particularly in Figure 45. The skirts 16 are bonded at 14 to the inside surface of the parent film 10.

As may be seen from Figure 42, two bags 100' are shown prior to their being separated along seam 101. This embodiment includes score lines 12 laid out in a pattern that includes a tear notch 24. The tear notch 24 provides a starting point for removing the fold structure 11, which is located above the zipper assembly 20. The parent film 10 is sealed at section 26 to either its opposing sides 35 and 36 or the structure of the zipper assembly 20. For ease of illustration, it is to be noted that seal 30a extends across notches 326, 326a in strip 320 and area 26a refers to the general area of the hermetic side seal 30a adjacent the notches 326, 326a. The fold structure being defined by the location of the score lines 12. The score lines 12 extend below the zipper assembly 20 for substantially the entire width of the reclosable gusseted bag 100', facilitating removal of the fold structure 11 and exposure of the zipper structure 20a. The embodiment of Figure 42 further includes a sealable fill opening 300 located below the zipper assembly and above the bottom gusset 310.

Referring now to Figures 43 and 44, a cross-sectional view of the embodiment of Figure 42 may be seen. In particular, the backing or barrier strip 320 is seen with an upper portion 324 thereof attached to the inside surface 17 of the zipper skirt 16. As may be further seen, a lower portion 322 of the barrier strip 320 is attached to the inside surface 32a of the bag 100' at a point just below the fill opening 300. As illustrated particularly in Figure 44, the lower portion 322 is seen prior to attachment to inside surface 32a, with the fill opening 300 in the open position. For illustration purposes, when opening 300 is shown in the closed position the web edges 400 are seen as not completely abutting. It is to be understood that while it is preferred that the edges 400 abut, it is within the scope of the present invention to include a closed opening 300 wherein the web edges 400 are not completely abutted.

Referring to Figure 45, the film 10 is folded over, as shown to form the fold structure 11 and a zipper assembly 20 is inserted. Weakened areas 12 are preferably positioned below the zipper structure 20a so that when the fold structure 11 is removed, the zipper structure 20a is exposed sufficiently above the resulting fin structures 19 to allow the user access to the zipper structure 20a. Zipper skirts 16 are shown bonded to the film 10. However, it is presently believed preferable, prior to insertion of the zipper assembly 20, that the uncut ends (not seen in these views) of each zipper assembly 20 be punched out or cut to form a radiused notch 22a, as shown in Figure 42. As seen in Figure 45, an upper portion 324 of a backing or barrier strip 320 is attached to the inside surface 17 of one of the zipper skirts 16. A lower portion 322 of the strip 320 extends beyond the distal margin 342 of the zipper skirt 16 and

is bonded to the inside surface 36a of side 36. It is presently believed preferable, prior to attachment to the zipper skirt 16, that the backing or barrier strip 320 be punched out or cut to form notch 326 (seen in Figure 47).

5 As may be further seen in Figure 47, barrier strip 320 is further punched prior to insertion into fold structure 11, to form notch 326a, also in register with side seal 30a. Notches 326 and 326a are positioned to be in register with radiused notch 22a of zipper assembly 20,
10 all of which are positioned to be in register with side seal 30a, seen in Figures 42 and 48. Consecutive notches 326, 326a in barrier strip 320 alleviate the presence of barrier strip 320 at side seal 30a, thus facilitating a hermetic seal at area 26a (best seen in Figure 42). The
15 hermetic seal is obtained by sealing inside opposing surfaces 35a, 36a at 26a and 30a. The inside surface 10a of parent film 10 is simultaneously sealed to the zipper skirts 16 at area 14, as seen in Figure 45, and simultaneously, inside surfaces 17 of skirts 16 (Figure
20 45) are sealed to each other in the notched out areas 326 and 326a at 26a, where the barrier strip is not present (seen best in Figure 42).

As illustrated in Figures 45 and 47, the skirt(s) 16 remain intact so that the zipper assembly 20 is kept
25 continuous for ease of handling. Once inserted, the skirt(s) of the zipper assembly 20 is bonded to the inside surface 10a of the parent film 10 at seal location(s) 14.

Referring to Figures 46, 47, and 48, the process by
30 which the alternative embodiment gusseted, side fill bag 100' (seen in Figures 42 - 45) is presently believed to be manufacturable is illustrated using an rpm 100 machine. The parent film 10 is fed over a predetermined number of rollers and toward the trapezoidal plow
35 structure 200a. In addition to the parent film 10, the

zipper assembly 20 and backing strip 320 are fed over the parent film 10. It is presently believed that the zipper assembly 20 and backing strip 320 must pass over the dancer rollers 203a so that they are kept sufficiently taut thus allowing notches 22a, 326, and 326a to be punched out accurately at predetermined positions such that the notches 22a and 326 will be in register with each other when the backing strip 320 is inserted between zipper skirts 16. Prior to being fed over the parent film 10, the zipper assembly 20 has a notch 22a die punched, by die 214' and heat sealed by sealer 216', at a predetermined position at seal 22b that is also designed to be in general alignment with the notch 326 in strip 320, formed by die 214'' and 326a formed by die 214'. It is to be noted that notch 326 is preferably formed such that the distal margin 342 of skirt 16 extends into the notch 326. This configuration allows notch 326a to be formed by die 214' with minimal chance of skirt 16 being inadvertently notched by die 214'. Die 214' simultaneously forms notches 326a and 22a. The parent film 10 is folded over the zipper assembly 20 to form the fold structure 11. Before the parent film 10 is passed over the trapezoidal plow 200a it passes over a zipper sealer mechanism 216 whereby the zipper skirts 16 are sealed to the parent film 10 at the inside surfaces 35a, 36a of opposing sides 35, 36 respectively. Unlike prior embodiments, no blade between the skirts 16 is needed during sealing since, as seen in Figure 45, the inner side 328 of strip 320 will not seal to the inside surface 17 of opposite zipper skirt 16. Further, gusset holes 344 are die punched by die 344a at a predetermined position designed to be in general alignment with side seal 30a. The gusset holes 344 allow gusset folds to be attached to each other at side seal 30a thereby adding rigidity to the gusset portion 310 of the gusseted bag

100'. This added rigidity enables the gusseted bag 100' to stand up by itself when placed on a flat surface such as a table or refrigerator shelf (not seen in these views). Further, with reference to the prior art
5 gusseted bags 460 seen in Figure 57, additional seals 470 may be included for additional rigidity and containment as would be desired with liquid products.

In addition, referring to Figures 46 and 47, optionally a header material 206 may be fed over the
10 parent film 10. The header strip 206, if used, is sealed to the parent film 10 at seal 206a, seen particularly in Figure 47. As seen in Figure 46, seal 206a is formed by heat sealer 216. Heat sealer 216 simultaneously seals the zipper skirt(a) 16 to the parent film 10 at 14. The
15 parent film 10, attached zipper assembly 20, and strip 320 are passed over roller 350. After the parent film 10 is folded and the zipper assembly 20 is inserted, the remaining manufacturing process is carried out as generally illustrated in Figure 48. The parent film 10
20 and attached zipper assembly 20 passes over a trapezoidal folding board or plow 200a. The folding step leaves a flat bottom prior to the parent film 10 being passed over a tucking board 334. The tucking board 334 reverse folds the previously formed flat bottom of the parent film 10
25 into a gusset 310. The side seal 30a is made. It is to be noted that the barrier strip 320 preferably marginally enters the area of side seal 30a at seal area 26a. Notches 326 and 326a preferably remove a majority of the barrier strip 320 in the seal 30a area to provide
30 hermetic seal 30a. Although it is preferred that the barrier strip 320 minimally enter the side seal 30a area at seal area 26a, it is within the province of the present invention to provide a barrier strip 320 which ends before, at, or beyond the side seal 30a area.
35 Further, it is to be understood that the present

invention may be practiced using a barrier strip 320 having longitudinally-spaced sealable areas whereby the notches 326 and 326a are not necessary and the sealable areas are arranged to be in alignment with the seal area 30a. Tear notch 24 is added to facilitate removal of the fold 11. An opening 123 is die punched in the package 100' to provide a point where the package 100' may be easily hung for display purposes. The package 100' is then cut along seam 101 from the bag making portion of the form fill and seal machine and transferred to the fill and seal stations where the side fill opening 300 is opened and the package 100' is filled through side fill opening 300. The opening 300, seen in Figure 48, is then hermetically sealed at seal 340, as seen in Figure 48.

The presence of the backing or barrier strip 320 permits the seal 340 to be formed while the inside surfaces 17 of zipper skirts 16 are not sealed to one another (see Figure 45). As previously described with reference to Figures 42-45, the inner side 328 of strip 320 will not seal to inside surface 35a or zipper skirt 16 during sealing, thus permitting a seal without the need for a blade between the skirts 16.

Referring now to Figures 49 - 52, an alternative embodiment gusseted, side fill bag 100' is illustrated. As may be seen, a press-to-close zipper assembly 20' having lower skirt(s) 16 and upper skirts 16a may be inserted in the fold structure 11. As in the embodiment shown in Figures 42-45a, the gusseted, reclosable bag 100' with press-to-close zipper assembly 20' seen in Figures 49-52 includes at least one sheet of web material 10 having at least two areas of structural weakness 12. The weakened areas 12 define an integral tear off portion or fold structure 11. The gusseted, reclosable bag 100' is further defined by a gusseted portion 310 and a sealable fill opening 300 which is located between the

fold structure 11 and gusseted portion 310. As best seen in Figure 52, the press-to-close zipper assembly 20' typically includes a male track structure 330 and a female track structure 331. The male track structure 330 and the female track structure 331 each include an upper zipper skirt 16a of web material extending therefrom and a lower zipper skirt 16 extending therefrom. Each zipper skirt 16, 16a includes a predetermined coupling area arranged to be sealed to the parent film 10 at sealing location 14.

As may be further seen in Figure 52, the zipper skirt(s) 16 is heat sealed to the inside surface 35a, 35b of side panels, 35 and 36 respectively, of the parent film 10. A backing or barrier strip 320 is located between, and extends below the zipper skirts 16. As discussed with reference to the embodiment shown in Figures 42 - 45, the backing or barrier strip 320 is preferably two-ply and composed of a laminate film such as Curwood's 7182 barrier film. As such, the strip includes a first side 328 and a second side 329. The first side 328 is preferably composed of Nylon, polypropylene, or any other substance known in the art that will not bond to the zipper skirt 16 or parent film 10 during heat sealing. The second side 329 may be provided with a sealant, such as a polyethylene, polyethylene blend, or a polyethylene co-extrusion. The second or sealant side 329 of the strip 320 is sealed or tacked to the inside surface 17 of a zipper skirt 16 prior to insertion in the fold structure 11 at a location adjacent the sealable side fill opening 300 at seal 335. The inner, resistant side 328 of strip 320 prevents the skirt(s) 16 from sealing together along their respective inner surface 17 during sealing of the side fill opening 300. The backing or barrier strip 320 is preferably notched at 326 and 326a, as seen in Figure 54, to allow

proper sealing of side seal 30a.

As may be seen from Figure 49, two bags 100' having press-to-close zipper assembly 20' are shown prior to their being separated along seam 101. The score lines 12 are seen to be laid out in a portion that includes a tear notch 24. The tear notch 24 provides a starting point for removing the fold structure 11, which is located above the press-to-close zipper assembly 20'. The fold structure 11 being defined by the location of the score lines 12. The parent film 10 is sealed at area 26a to either its opposing sides 35 and 36 or the structure of the press-to-close zipper assembly 20'. For ease of illustration, it is noted that the seal 30a extends down across notches 326, 326a in strip 320. Reference numeral 26a refers to this general area of hermetic side seal 30a. The embodiment seen in Figure 49 further includes a sealable fill opening 300 located below the fold structure 11 and above the bottom gusset 310.

Referring now to Figures 50 and 51, a cross sectional view of the embodiment of Figure 49 may be seen. The backing or barrier strip 320 is particularly seen, with the upper portion 324 thereof attached to the inside surface 17 of zipper skirt 16. The lower portion 322 of the barrier strip 320 is attached to the inside surface 36a of the parent film 10 at a point below the fill opening 300. As illustrated particularly in Figure 51, the lower portion 322 is seen prior to attachment to inside surface 36a, with the fill opening 300 in the open position. For illustration purposes, when opening 300 is shown in the closed position, as in Figure 52, for example, web edges 400 are seen as not completely abutting. It is to be understood that while it is preferred that web edges 400 completely abut when opening 300 is in the closed and sealed position, it is within the scope of the present invention to include a closed

opening 300 having non-abutting web edges 400.

Referring now to Figures 53- 55a, the process by which the alternative embodiment, gusseted, side fill bag 100' (seen in Figures 49-52) is illustrated. Seen particularly in Figure 54, a press-to-close zipper assembly 20' may be introduced prior to the trapezoidal plow structure 200a. The parent film 10 is fed over a predetermined number of rollers and toward the plow 200a.

The press-to-close zipper assembly 20' and backing strip 320 are fed over the parent film 10. It is presently believed that the press-to-close zipper assembly 20' and backing strip 320 must pass over the dancer rollers 203a so that they are kept sufficiently taut to allow notches 326, and 326a to be punched out accurately at predetermined positions such that the notches 326 and 326a will be in register with each other when the backing strip 320 is inserted between zipper skirts 16. As seen in Figure 54, notch 326 is punched out prior to insertion of the strip 320 between skirt(s) 16, whereas notch 326a is punched out prior to insertion of press-to-close zipper assembly 20' into fold structure 11. It may be further seen that notch 326 is preferably formed such that the distal margin 342 of skirt 16 extends into the notch 326. This configuration allows notch 326a to be formed by die 214' while preventing skirt 16 from inadvertent notching by die 214'. Die 214" punches notch 326. Figure 55a illustrates the position of notches 326, 326a relative the backing strip 320 and distal margin 342 of zipper skirts 16. The press-to-close zipper assembly 20' is heat sealed by sealer 216 to strip 320 at seal 335.

The parent film 10 is folded over the press-to-close zipper assembly 20' to form the fold structure 11.

As seen in Figure 53, prior to being passed over the trapezoidal plow 200a, the parent film 10 it passes over

a zipper sealer mechanism 216 whereby the zipper skirts 16 are sealed to the parent film 10 at the inside surfaces 35a, 35b of opposing sides 35, 36 respectively.

5 As is further seen in Figure 53, the press-to-close zipper assembly 20' and backing strip 320 further passes over a blade 450 which allows the skirts 16 and 16a to be heat sealed to the web 10 while preventing the inner surfaces 17 of the skirts 16, 16a from sealing together.

10 Further, gusset holes 344 are die punched by die 344a at a predetermined position designed to be in general alignment with side seal 30a. The gusset holes 344 allow gusset folds to be attached to each other at side seal 30a thereby adding rigidity to the gusset portion 310 of the gusseted bag 100'. This added rigidity enables the
15 gusseted bag 100' to stand up by itself when placed on a flat surface, such as a table or refrigerator shelf (not seen in these views).

Again referring to Figures 53 and 54, optionally a header material 206 may be fed over the parent film 10.

20 The header strip 206, if used, is sealed to the parent film 10 at seal 206a, seen particularly in Figure 54. After the parent film 10 is folded and the press-to-close zipper assembly 20' and strip 320 are inserted, the remaining manufacturing process is carried out as
25 generally illustrated in Figure 55. The parent film 10 with attached press-to-close zipper assembly 20' and strip 320 passes over a trapezoidal folding board or plow 200a. The folding step leaves a flat bottom prior to the parent film 10 being passed over a tucking board 334. As
30 is also illustrated in the manufacturing steps of the gusseted bag 100' seen in Figures 42-45, the tucking board 334 reverse folds the previously formed flat bottom of the parent film 10 into a gusset 310. The side seal 30a is made and tear notch 24 is added to facilitate
35 removal of the fold structure 11. It may be seen that

the barrier strip 320 preferably marginally enters the area of side seal 30a at seal area 26a. A majority of the strip 320 is removed by notches 326 and 326a, thereby allowing a hermetic seal to be formed at 30a. Although
5 it is preferred that the barrier strip 320 minimally enter the side seal 30a area, it is to be understood that the barrier strip may end before, at, or beyond the side seal 30a at area 26a. An opening 123 is die punched in the package 100' to provide a point where the package
10 100' may be easily hung for display purposes. As seen in Figure 55, the package 100' is then cut along seam 101 from the bag making portion of the form fill and seal machine and transferred to the fill and seal stations where the side fill opening 300 is opened and the package
15 100' is filled through side fill opening 300. The opening 300 is then hermetically sealed at seal 340. The seal 340 is formed without use of a blade between the skirts 16, due to the presence of strip 320 between the skirts 16 which prevents the inside surfaces 17 of skirts
20 16 from sealing together while the opening 300 is sealed.

It is to be understood that the gusseted, side fill bags 100 and 100' having a backing or barrier strip 320 may alternatively include any of the features disclosed with reference to the embodiments shown in Figures 1 -42.
25 Furthermore, although not shown in the Figures, it is within the scope of the present invention to provide a brush applied, anti-seal agent to the inside surface 17 of zipper skirts 16. A brush applied, anti-seal agent such as nitrocellulose obtained from Amantceh may thereby
30 take the place of the barrier or backing strip 320 and provide a non-bonding function to the inside surface 17 of the zipper skirts 16 during seal of the fill opening 300.

The foregoing is considered as illustrative only of
35 the principles of the invention. Furthermore, since

numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described.

What is claimed:

1. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material including at least two areas of structural weakness, having at least one fold structure
5 located between and defined by said two areas of structural weakness, and an opening located generally opposite said fold structure; a reclosable fastener structure including a skirt structure of skirt web material extending therefrom; said skirt structure
10 including a distal margin; said distal margin being coupled to said web material at, at least one location between said areas of structural weakness and said opening; said reclosable fastener structure extending past said areas of structural weakness and into said fold
15 structure; said reclosable bag capable of being filled with at least one food product through said opening.
2. The reclosable bag of claim 1 wherein the skirt web material is integral to the reclosable fastener structure.
3. The reclosable bag of claim 1 wherein the skirt web material is coupled to the reclosable fastener structure.
4. The reclosable bag of claim 1 wherein the integral skirt includes an outside surface and an inside surface; the distal margin being located on the outside surface; the inside surface including predetermined area having a
5 releasable adhesive material thereon; whereby a peelable seal may be formed.
5. The reclosable bag of claim 4 wherein the peelable seal, when formed, is hermetic.
6. The reclosable bag of claim 1 wherein said web material of said reclosable bag is substantially comprised of a sheet of a parent film material having predetermined dimensions.
7. The parent film material of claim 6 wherein the

areas of structural weakness are integral to said parent film.

8. The reclosable bag of claim 1 wherein said areas of structural weakness extend linearly across a predetermined dimension of said sheet of web material.

9. The reclosable bag of claim 8 wherein the predetermined dimension is width.

10. The reclosable bag of claim 8 wherein the predetermined dimension is length.

11. The reclosable bag of claim 1 wherein said areas of structural weakness extend non-linearly across a predetermined dimension of said sheet of said web material.

12. The reclosable bag of claim 11 wherein the predetermined dimension is width.

13. The reclosable bag of claim 11 wherein the predetermined dimension is length.
14. The reclosable bag of claim 1 wherein said areas of structural weakness extend across a predetermined dimension of said sheet of web material in a predetermined pattern.
15. The reclosable bag of claim 1 wherein said areas of structural weakness comprise perforations.
16. The reclosable bag of claim 1 wherein said areas of structural weakness comprise scoring.
17. The reclosable bag of claim 1 wherein said areas of structural weakness comprise microperforations.
18. The reclosable bag of claim 1 wherein said sheet of web material is comprised of a multiple laminate film.
19. The reclosable bag of claim 18 wherein said multiple laminate film includes at least one layer of material comprising a tear path.
20. The reclosable bag of claim 19 wherein said tear path is hermetic.
21. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material including a first area of structural weakness and a second area of structural weakness; said sheet of web material including at least one fold structure located between and defined by said first and second areas of structural weakness, and a fill opening; said sheet of web material including a first panel coupled to said fold structure adjacent said first area of structural weakness and a second panel coupled to said fold structure adjacent said second area of structural weakness; a reclosable fastener structure including a male track structure and a female track structure; said male track structure including a first fin structure of web material extending therefrom and

said female track structure including a second fin structure of web material extending therefrom; each said fin structure including a predetermined coupling portion; said coupling portion of said first fin structure being
20 coupled to said first panel and said coupling portion of said second fin structure being coupled to said second panel; said reclosable fastener structure extending past said areas of structural weakness and into said fold structure; said areas of structural weakness being
25 located below said reclosable fastener structure; said reclosable bag capable of being filled with at least one food product through said fill opening.

22. The reclosable bag of claim 21 wherein said areas of structural weakness are hermetic.

23. The reclosable bag of claim 21 wherein said fill opening is located generally opposite said fold structure.

24. The reclosable bag of claim 21 wherein said first fin structure is larger than said second fin structure.

25. The reclosable bag of claim 21 wherein said first fin structure and said second fin structure each include a distal margin; said distal margins facing each other and at least one distal margin being coated with a
5 releasable adhesive material.

26. The reclosable bag of claim 25 wherein said distal margins are releasably coupled to each other by said releasable adhesive material.

27. The reclosable bag of claim 25 wherein at least one said distal margin is coated with said releasable adhesive material and said distal margin is coupled to a predetermined portion of said web material.

28. The reclosable bag of claim 21 wherein said first fin structure and said second fin structure are integral to each other and include a predetermined area of structural weakness located between said coupling portion

5 of said first fin structure and said coupling portion of said second fin structure.

29. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material, at least one tear tape structure, at least one fold structure, and an opening located
5 generally opposite said fold structure; a reclosable fastener structure including at least one integral skirt structure of skirt web material extending therefrom; said integral skirt structure including at least one distal margin; said distal margin being coupled to said web
10 material at, at least one location between said tear tape structure and said opening; said reclosable fastener structure extending past said tear tape structure and into said fold structure; said reclosable bag capable of being filled with at least one food product.

30. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material having at least one fold structure presenting at least two sidewall structures having inside
5 surfaces, and an opening located generally opposite said fold structure; a reclosable fastener structure including an integral skirt structure comprising a web material extending therefrom and including opposed distal margin structures; said web material of said integral skirt
10 structure being sealed to said inside surfaces at a plurality of predetermined sealing areas; a barrier web material extending between and coupled to said distal margin structures.

31. The reclosable bag of claim 30 wherein said barrier web material extends between and is coupled to said sidewall structures.

32. The reclosable bag of claim 31 wherein said barrier web material is coupled to at least one of said sidewall structures by at least one peelable seal.

33. The reclosable bag of claim 30 wherein said predetermined sealing areas are located on said respective sidewall structures.

34. The reclosable bag of claim 30 wherein said barrier web material is coupled to said predetermined sealing areas by at least one peelable seal.

35. The reclosable bag of claim 30 wherein said barrier web material includes at least one area of structural weakness extending generally parallel to said predetermined sealing areas.

36. The reclosable bag of claim 31 wherein said barrier web material includes at least one area of structural weakness extending generally parallel to said predetermined sealing areas.

37. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material including at least one predetermined tear area, at least one fold structure, and
5 an opening located generally opposite said fold structure; a reclosable fastener structure including at least one integral skirt structure of skirt web material extending therefrom; said integral skirt structure including at least one distal margin; said distal margin
10 being coupled to said web material at, at least one location between said tear area and said opening; said reclosable fastener structure extending past said tear area and into said fold structure; said reclosable bag capable of being filled with at least one food product.

38. The reclosable bag of claim 37 further including at least one header material located in a predetermined area of said fold structure.

39. The reclosable bag of claim 38 wherein said header material includes at least one edge structure adjacent said tear area.

40. The reclosable bag of claim 37 further including at

least one tear tape structure coupled to said web material and adjacent to said tear area.

41. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material having a propensity to tear along at last two predetermined tear areas; having at least one
5 fold structure located between and defined by said two tear areas, and an opening located generally opposite said fold structure; a reclosable fastener structure including a skirt structure of skirt web material extending therefrom; said skirt structure including a
10 distal margin; said distal margin being coupled to said web material at, at least one location between said two tear areas and said opening; said reclosable fastener structure extending past said two tear areas and into said fold structure; said reclosable bag capable of being
15 filled with at least one food product through said opening.

42. The reclosable bag of claim 41 wherein the skirt web material is integral to the reclosable fastener structure.

43. The reclosable bag of claim 41 wherein the skirt web material is coupled to the reclosable fastener structure.

44. The reclosable bag of claim 41 wherein the integral skirt includes an outside surface and an inside surface; the distal margin being located on the outside surface; the inside surface including predetermined area having a
5 releasable adhesive material thereon; whereby a peelable seal may be formed.

45. The reclosable bag of claim 41 wherein the peelable seal, when formed, is hermetic.

46. The reclosable bag of claim 41 wherein said web material of said reclosable bag is substantially comprised of a sheet of a parent film material having predetermined dimensions.

47. The parent film material of claim 46 wherein the tear areas are integral to said parent film.
48. The reclosable bag of claim 41 wherein said tear areas extend linearly across a predetermined dimension of said sheet of web material.
49. The reclosable bag of claim 48 wherein the predetermined dimension is width.
50. The reclosable bag of claim 48 wherein the predetermined dimension is length.
51. The reclosable bag of claim 41 wherein said tear areas extend nonlinearly across a predetermined dimension of said sheet of said web material.
52. The reclosable bag of claim 51 wherein the predetermined dimension is width.
53. The reclosable bag of claim 51 wherein the predetermined dimension is length.
54. The reclosable bag of claim 41 wherein said tear areas extend across a predetermined dimension of said sheet of web material in a predetermined pattern.
55. The reclosable bag of claim 41 wherein said tear areas comprise perforations.
56. The reclosable bag of claim 41 wherein said tear areas comprise scoring.
57. The reclosable bag of claim 41 wherein said tear areas comprise microperforations.
58. The reclosable bag of claim 41 wherein said sheet of web material is comprised of a multiple laminate film.
59. The reclosable bag of claim 58 wherein at least one layer of said multiple laminate film material includes said tear areas.
60. The reclosable bag of claim 59 wherein said tear areas are hermetic.
61. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material having at least one fold structure

located between at least two predetermined areas having
5 a propensity to tear in a predetermined direction and
presenting at least two sidewall structures having inside
surfaces, and an opening located generally opposite said
fold structure; a reclosable fastener structure, located
in said fold structure, including a skirt structure
10 comprising a web material extending therefrom and
including opposed distal margin structures; said web
material of said integral skirt structure being sealed to
said inside surfaces at a plurality of predetermined
sealing areas.

62. The reclosable bag of claim 61 further comprising
a barrier web material extending between and coupled to
said distal margin structures.

63. A method of manufacturing a reclosable bag for
filling with at least one food product, said reclosable
bag comprising: at least one sheet of web material
including a first area of structural weakness and a
5 second area of structural weakness; said sheet of web
material including at least one fold structure located
between and defined by said first and second areas of
structural weakness, and a fill opening; said sheet of
web material including a first panel coupled to said fold
10 structure adjacent said first area of structural weakness
and a second panel coupled to said fold structure
adjacent said second area of structural weakness; a
reclosable fastener structure including a male track
structure and a female track structure; said male track
15 structure including a first fin structure of web material
extending therefrom and said female track structure
including a second fin structure of web material
extending therefrom; each said fin structure including a
predetermined coupling portion; said coupling portion of
20 said first fin structure being coupled to said first
panel and said coupling portion of said second fin

- structure being coupled to said second panel; said reclosable fastener structure extending past said areas of structural weakness and into said fold structure; said
- 25 areas of structural weakness being located below said reclosable fastener structure; said reclosable bag capable of being filled with at least one food product through said fill opening, said method comprising:
- 30 folding said sheet of web material along a predetermined folding area located between said areas of structural weakness to form said fold structure;
- inserting said reclosable fastener into said fold structure;
- coupling said distal margin of said integral skirt
- 35 structure to said web material;
- sealing said web material along at least two predetermined linear areas located generally perpendicular to said fold structure;
- filling said reclosable bag with at least one food
- 40 product through said opening; and sealing said opening.
64. The method of claim 63 wherein the step of sealing said web material along at least two predetermined linear areas occurs last.
65. The method of claim 63 wherein the first step is
- 5 coupling at least one predetermined portion of said distal margin of said integral skirt structure to at least one predetermined portion of said web material prior to folding said sheet of web material.
66. The method of claim 63 including the further step of inserting and sealing a header material into said predetermined fold area at least prior to the step of sealing said web material along at least said two
- 5 predetermined linear areas.
67. The method of claim 63 including the further step of inserting and sealing at least one tear structure into said predetermined fold area at least prior to the step

5 of sealing said web material along at least said two predetermined linear areas.

68. The method of claim 63 including the further step of sealing a predetermined portion of said fold structure and forming a header structure; said further step being subsequent to said step of folding said sheet of web material along a predetermined folding area located between said areas of structural weakness to form said fold structure.

69. A method of manufacturing a reclosable bag for filling with at least one food product, said reclosable bag including at least one sheet of web material having at least one predetermined tear area, at least one fold structure, and an opening located generally opposite said fold structure; a reclosable fastener assembly including at least one integral skirt structure of skirt web material extending therefrom; said integral skirt structure including at least one distal margin; said distal margin being coupled to said web material at, at least one location between said tear area and said opening; said reclosable fastener structure extending past said tear area and into said fold structure; said reclosable bag capable of being filled with at least one food product, said method comprising: folding said sheet of web material along a predetermined folding area to produce said fold structure; inserting said reclosable fastener assembly into said fold structure; coupling said distal margin of said integral skirt structure to said web material; sealing said web material along at least two predetermined linear areas located generally perpendicular to said fold structure; filling said reclosable bag with at least one food product through said opening; and sealing said opening.

70. The method of claim 69 wherein the step of sealing said web material along at least two predetermined linear

areas occurs last.

71. The method of claim 69 wherein the first step is coupling at least one predetermined portion of said distal margin of said integral skirt structure to at least one predetermined portion of said web material
5 prior to folding said sheet of web material.

72. The method of claim 69 including the further step of inserting and sealing a header material into said predetermined fold area at least prior to the step of sealing said web material along at least said two
5 predetermined linear areas.

73. The method of claim 69 including the further step of inserting and sealing at least one tear structure into said predetermined fold area at least prior to the step of sealing said web material along at least said two
5 predetermined linear areas.

74. The method of claim 69 including the further step of sealing a predetermined portion of said fold structure and forming a header structure; said further step being subsequent to said step of folding said sheet of web
5 material along a predetermined folding area located between said areas of structural weakness to form said fold structure.

75. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material including at least two areas of structural weakness, having at least one fold structure
5 located between and defined by said two areas of structural weakness, and an opening located generally opposite said fold structure; a reclosable fastener structure including a skirt structure of skirt web material extending therefrom; said skirt structure
10 including a distal margin; said distal margin being coupled to said web material at, at least one location between said areas of structural weakness and said

opening; said reclosable fastener structure extending past said areas of structural weakness; said reclosable
15 bag capable of being filled with at least one food product through said opening.

76. The reclosable bag of claim 75 wherein said reclosable fastener structure extends over said fold structure.

77. The reclosable bag of claim 75 wherein the skirt web material is integral to the reclosable fastener structure.

78. The reclosable bag of claim 75 wherein the skirt web material is coupled to the reclosable fastener structure.

79. The reclosable bag of claim 75 wherein the web material includes an outside surface and an inside surface; the inside surface including a predetermined area having a releasable adhesive material thereon;
5 whereby a peelable seal may be formed.

80. The reclosable bag of claim 79 wherein the peelable seal, when formed, is hermetic.

81. The reclosable bag of claim 75 wherein said web material of said reclosable bag is substantially comprised of a sheet of a parent film material having predetermined dimensions.

82. The parent film material of claim 81 wherein the areas of structural weakness are integral to said parent film.

83. The reclosable bag of claim 75 wherein said areas of structural weakness extend linearly across a predetermined dimension of said sheet of web material.

84. The reclosable bag of claim 83 wherein the predetermined dimension is width.

85. The reclosable bag of claim 83 wherein the predetermined dimension is length.

86. The reclosable bag of claim 75 wherein said areas of structural weakness extend nonlinearly across a

predetermined dimension of said sheet of said web material.

87. The reclosable bag of claim 86 wherein the predetermined dimension is width.

88. The reclosable bag of claim 86 wherein the predetermined dimension is length.

89. The reclosable bag of claim 75 wherein said areas of structural weakness extend across a predetermined dimension of said sheet of web material in a predetermined pattern.

90. The reclosable bag of claim 75 wherein said areas of structural weakness comprise perforations.

91. The reclosable bag of claim 75 wherein said areas of structural weakness comprise scoring.

92. The reclosable bag of claim 75 wherein said areas of structural weakness comprise microperforations.

93. The reclosable bag of claim 75 wherein said sheet of web material is comprised of a multiple laminate film.

94. The reclosable bag of claim 93 wherein said multiple laminate film includes at least one layer of material comprising a tear path.

95. The reclosable bag of claim 94 wherein said tear path is hermetic.

96. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material including at least two areas of structural weakness, having at least one fold structure located between and defined by said two areas of structural weakness, and an opening located generally opposite said fold structure; a reclosable fastener structure including a skirt structure of skirt web material extending therefrom; said skirt structure including a distal margin; said distal margin being coupled to said web material at, at least one location between said areas of structural weakness and said

opening; said reclosable fastener structure extending
past said areas of structural weakness and over said fold
15 structure; said reclosable bag capable of being filled
with at least one food product through said opening.

97. The reclosable bag of claim 96 wherein the skirt web
material is integral to the reclosable fastener
structure.

98. The reclosable bag of claim 96 wherein the skirt web
material is coupled to the reclosable fastener structure.

99. The reclosable bag of claim 96 wherein the web
material includes an outside surface and an inside
surface; the inside surface including a predetermined
area having a releasable adhesive material thereon;
5 whereby a peelable seal may be formed.

100. The reclosable bag of claim 99 wherein the peelable
seal, when formed, is hermetic.

101. The reclosable bag of claim 96 wherein said web
material of said reclosable bag is substantially
comprised of a sheet of a parent film material having
predetermined dimensions.

102. The parent film material of claim 101 wherein the
areas of structural weakness are integral to said parent
film.

103. The reclosable bag of claim 96 wherein said areas
of structural weakness extend linearly across a
predetermined dimension of said sheet of web material.

104. The reclosable bag of claim 103 wherein the
predetermined dimension is width.

105. The reclosable bag of claim 103 wherein the
predetermined dimension is length.

106. The reclosable bag of claim 96 wherein said areas
of structural weakness extend nonlinearly across a
predetermined dimension of said sheet of said web
material.

107. The reclosable bag of claim 106 wherein the

predetermined dimension is width.

108. The reclosable bag of claim 106 wherein the predetermined dimension is length.

109. The reclosable bag of claim 96 wherein said areas of structural weakness extend across a predetermined dimension of said sheet of web material in a predetermined pattern.

110. The reclosable bag of claim 96 wherein said areas of structural weakness comprise perforations.

111. The reclosable bag of claim 96 wherein said areas of structural weakness comprise scoring.

112. The reclosable bag of claim 96 wherein said areas of structural weakness comprise microperforations.

113. The reclosable bag of claim 96 wherein said sheet of web material is comprised of a multiple laminate film.

114. The reclosable bag of claim 113 wherein said multiple laminate film includes at least one layer of material comprising a tear path.

115. The reclosable bag of claim 114 wherein said tear path is hermetic.

116. A reclosable bag for filling with at least one food product, said reclosable bag comprising: at least one sheet of web material, at least one tear tape structure, at least one fold structure, and an opening located generally opposite said fold structure; a reclosable fastener structure including at least one integral skirt structure of skirt web material extending therefrom; said integral skirt structure including at least one distal margin; said distal margin being coupled to said web material at, at least one location between said tear tape structure and said opening; said reclosable fastener structure extending past said tear tape structure and over said fold structure; said reclosable bag capable of being filled with at least one food product.

117. A reclosable bag for filling with at least one food

product, said reclosable bag comprising: at least one sheet of web material including at least two areas of structural weakness, having at least one fold structure located between and defined by said two areas of structural weakness; a gusseted portion located generally opposite said fold structure, and an opening located between said fold structure and said gusseted portion; a reclosable fastener structure including a skirt structure of skirt web material extending therefrom; said skirt structure including a distal margin; said distal margin being coupled to said web material at, at least one location between said areas of structural weakness and said opening; said reclosable fastener structure extending past said areas of structural weakness and into said fold structure; said reclosable bag capable of being filled with at least one food product through said opening.

118. The reclosable bag of claim 117 wherein the skirt web material is integral to the reclosable fastener structure.

119. The reclosable bag of claim 117 wherein the skirt web material is coupled to the reclosable fastener structure.

120. The reclosable bag of claim 118 wherein the integral skirt includes an outside surface and an inside surface, and wherein, each of said surfaces includes a respective upper and lower portion.

121. The reclosable bag of claim 120 further including a backing strip located opposite said opening and between said inside surface and said opening;

said backing strip including two opposed surfaces, at least a portion of one of said surfaces having an adhesive deposited thereon;

whereby said portion of said backing strip may be adhesively joined with the inside surface of the integral

skirt.

122. The reclosable bag of claim 121 wherein said backing strip extends below said lower portion of said inside surface.

123. The reclosable bag of claim 117 wherein said web material of said reclosable bag is substantially comprised of a sheet of a parent film material having predetermined dimensions.

124. The parent film material of claim 123 wherein the areas of structural weakness are integral to said parent film.

125. The reclosable bag of claim 117 wherein said areas of structural weakness extend linearly across a predetermined dimension of said sheet of web material.

126. The reclosable bag of claim 125 wherein the predetermined dimension is width.

127. The reclosable bag of claim 125 wherein the predetermined dimension is length.

128. The reclosable bag of claim 117 wherein said areas of structural weakness extend nonlinearly across a predetermined dimension of said sheet of said web material.

129. The reclosable bag of claim 128 wherein the predetermined dimension is width.

130. The reclosable bag of claim 128 wherein the predetermined dimension is length.

131. The reclosable bag of claim 117 wherein said areas of structural weakness extend across a predetermined dimension of said sheet of web material in a predetermined pattern.

132. The reclosable bag of claim 117 wherein said areas of structural weakness comprise perforations.

133. The reclosable bag of claim 117 wherein said areas of structural weakness comprise scoring.

134. The reclosable bag of claim 117 wherein said areas

of structural weakness comprise microperforations.

135. The reclosable bag of claim 117 wherein said sheet of web material is comprised of a multiple laminate film.

136. The reclosable bag of claim 135 wherein said multiple laminate film includes at least one layer of material comprising a tear path.

137. A reclosable bag for filling with at least one food product, said reclosable bag comprising:

at least one sheet of web material including a first area of structural weakness and a second area of structural weakness;

said sheet of web material including at least one fold structure located between and defined by said first and second areas of structural weakness,

a gusseted portion located generally opposite said fold structure;

and a fill opening located generally between said fold portion and said gusseted portion;

a reclosable fastener structure including a male track structure and a female track structure;

said male track structure including a first fin structure of web material extending therefrom and said female track structure including a second fin structure of web material extending therefrom;

each said fin structure including a predetermined coupling portion; said coupling portions coupled to said web material;

one of said fin structures being located adjacent said fill opening and including a backing strip;

said backing strip located generally opposite said fill opening;

said reclosable fastener structure extending past said areas of structural weakness and into said fold structure;

said reclosable bag capable of being filled with at

- 30 least one food product through said fill opening.
138. A method of manufacturing a reclosable bag for filling with at least one food product; said reclosable bag including at least one sheet of web material having at least two areas of structural weakness; at least one
- 5 fold structure located between and defined by said two areas of structural weakness; a gusseted portion located generally opposite said fold structure, and an opening located generally between said fold structure and said gusseted portion; a reclosable fastener assembly
- 10 including a skirt structure of skirt web material extending therefrom; said skirt structure including a distal margin; said distal margin being coupled to said web material at, at least one location between said areas of structural weakness and said opening; said reclosable
- 15 fastener assembly extending past said areas of structural weakness and into said fold structure; a backing strip located opposite said opening and between said skirt structure; said reclosable bag capable of being filled with at least one food product, said method comprising:
- 20 folding said sheet of web material along a predetermined folding area to produce said fold structure;
- attaching said backing strip to said skirt structure;
- 25 inserting said reclosable fastener assembly into said fold structure;
- coupling said distal margin of said integral skirt structure to said web material;
- folding said web material to produce said gusseted
- 30 portion;
- sealing said web material along at least two predetermined linear areas located generally perpendicular to said fold structure;
- filling said reclosable bag with at least one food

35 product through said opening; and
sealing said opening.

139. The method of claim 138 further including the step
of inserting and sealing a header material into said
predetermined fold area at least prior to the step of
sealing said web along at least two predetermined linear
5 areas.

140. A reclosable bag for filling with at least one food
product, said reclosable bag comprising:

a reclosable fastener assembly coupled to said
reclosable bag;

5 said reclosable bag having a gusseted portion
located substantially opposite said reclosable fastener
assembly;

said reclosable bag further including at least one
side opening located between said reclosable fastener
10 assembly and said gusseted portion of said reclosable bag
for filling with at least one food product.

141. The reclosable bag of claim 140 wherein said
reclosable fastener assembly includes a skirt structure
of skirt web material extending therefrom;

said skirt structure including a distal margin.

142. The reclosable bag of claim 141 wherein the
integral-skirt includes an outside surface and an inside
surface, and wherein each of said surfaces includes a
respective upper and lower portion.

143. The reclosable bag of claim 142 further including
a backing strip located opposite said opening and between
said inside surface and said opening;

5 said backing strip extending below said lower
portion of said inside surface;

said backing strip including two opposed surfaces,
at least a portion of one of said surfaces having an
adhesive deposited thereon;

whereby said portion of said backing strip may be

- 10 adhesively joined with the inside surface of the integral skirt.
144. A reclosable bag for filling with at least one food product, said reclosable bag comprising:
- at least one sheet of web material;
 - a reclosable fastener structure including a skirt
 - 5 structure extending therefrom;
 - said skirt structure including a distal margin;
 - said distal margin being coupled to said web material at a predetermined location;
 - a gusseted structure located opposite said
 - 10 reclosable fastener structure;
 - an opening located between said reclosable fastener structure and said gusseted structure; and
 - said reclosable bag capable of being filled with at least one food product through said opening.
145. A reclosable bag for filling with at least one food product, said reclosable bag comprising:
- at least one sheet of web material including at least two areas of structural weakness, having at least
 - 5 one fold structure located between and defined by said two areas of structural weakness;
 - a gusseted structure located opposite said fold structure;
 - a reclosable fastener including a skirt structure
 - 10 extending therefrom;
 - said skirt structure including a distal margin;
 - said distal margin being coupled to said web material at, at least one location located between said areas of structural weakness and said gusseted structure;
 - 15 and
 - said reclosable fastener structure extending past said areas of structural weakness and into said fold structure.
146. A method of manufacturing a reclosable bag for

filling with at least one food product, said reclosable bag including at least one sheet of web material; a reclosable fastener structure including a skirt structure extending therefrom; said skirt structure including a distal margin; said distal margin being coupled to said web material at a predetermined location; a gusseted structure located opposite said reclosable fastener structure; an opening located between said reclosable fastener structure and said gusseted structure; said method comprising:

coupling said distal margin of said skirt structure to said web material;

folding said web material to produce said gusseted structure;

sealing said web material along at least one predetermined area located generally perpendicular to said gusseted structure;

filling said reclosable bag with at least one food product through said opening; and

sealing said opening.

147. A method of manufacturing a reclosable bag for filling with at least one food product, said reclosable bag including at least one sheet of web material having at least two areas of structural weakness; at least one fold structure located between and defined by said at least two areas of structural weakness; a gusseted portion located opposite said fold structure; a reclosable fastener assembly including a skirt structure extending therefrom; said skirt structure including a distal margin; said distal margin being coupled to said web material at, at least one location between said areas of structural weakness and said gusseted portion; said reclosable fastener structure extending past said areas of structural weakness and into said fold structure; said reclosable bag capable of being filled with at least one

food product, said method comprising:

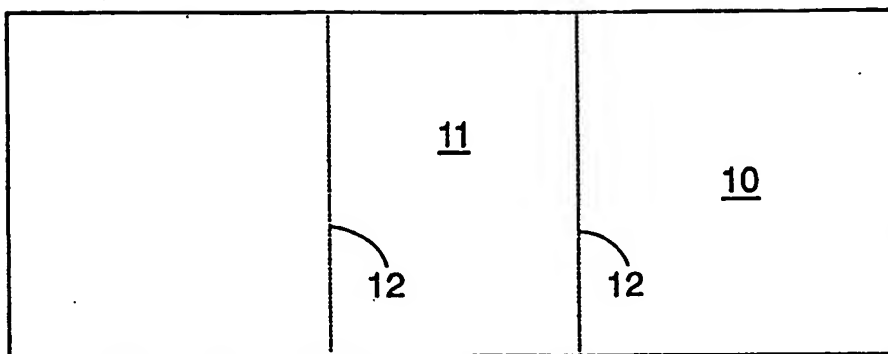
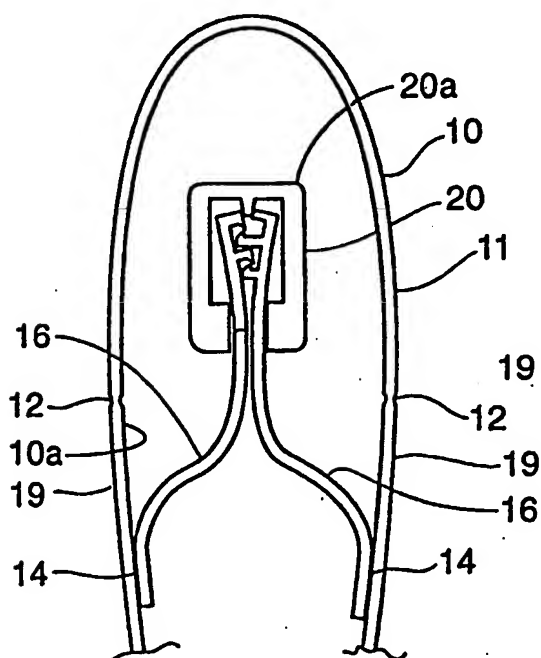
folding said skirt of web material along a predetermined folding area to produce said fold structure;

20 inserting said reclosable fastener assembly into said fold structure;

coupling said distal margin of said integral skirt structure to said web material;

25 folding said web material to produce said gusseted portion; and

sealing said web material along at least one predetermined linear area located generally perpendicular to said fold structure.

*Fig. 1**Fig. 2**Fig. 3*

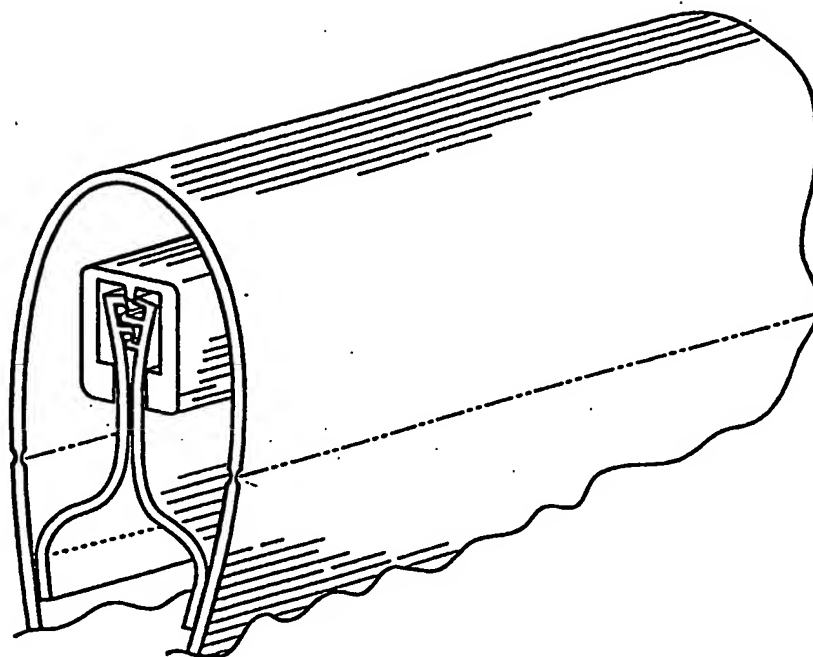


Fig. 4

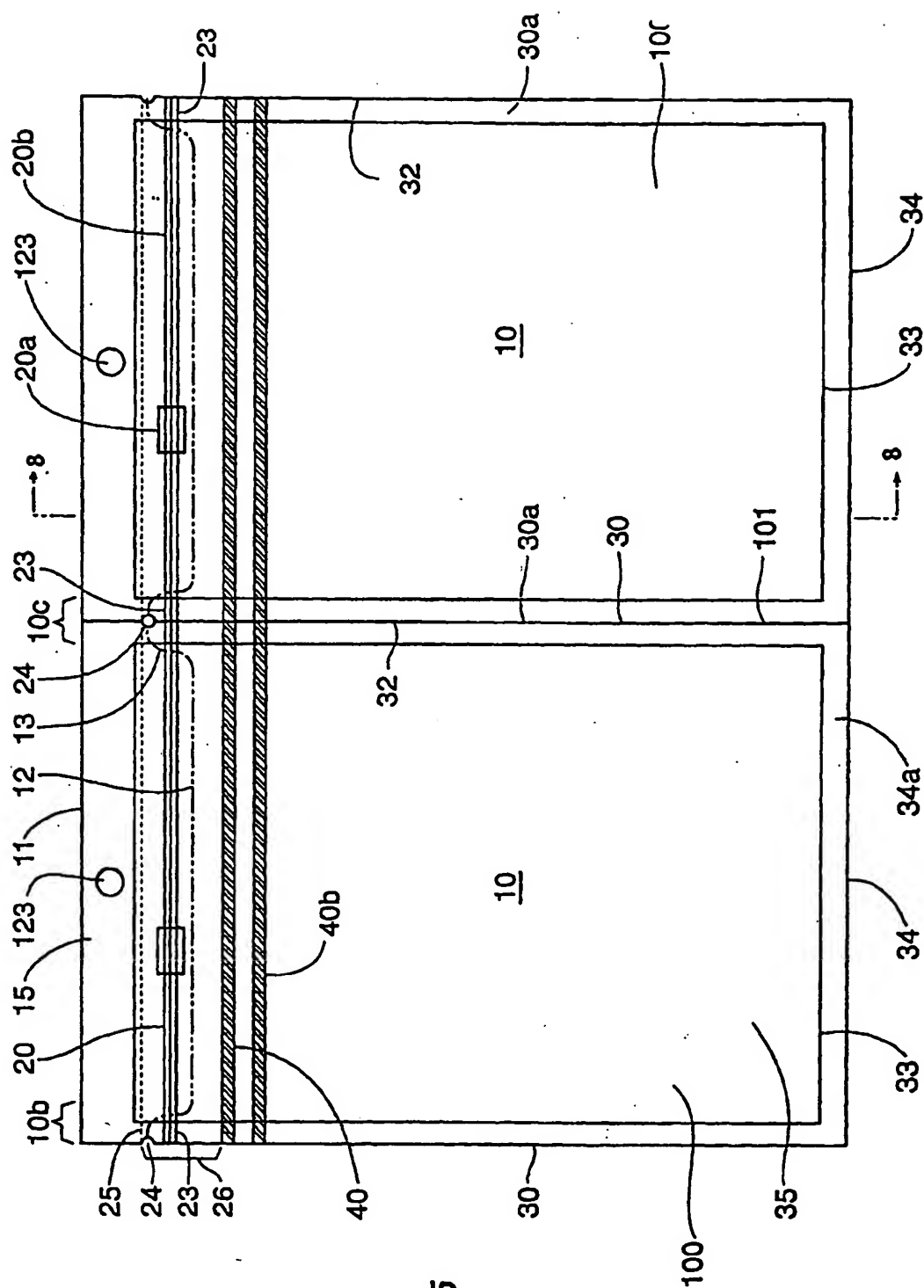


Fig. 5

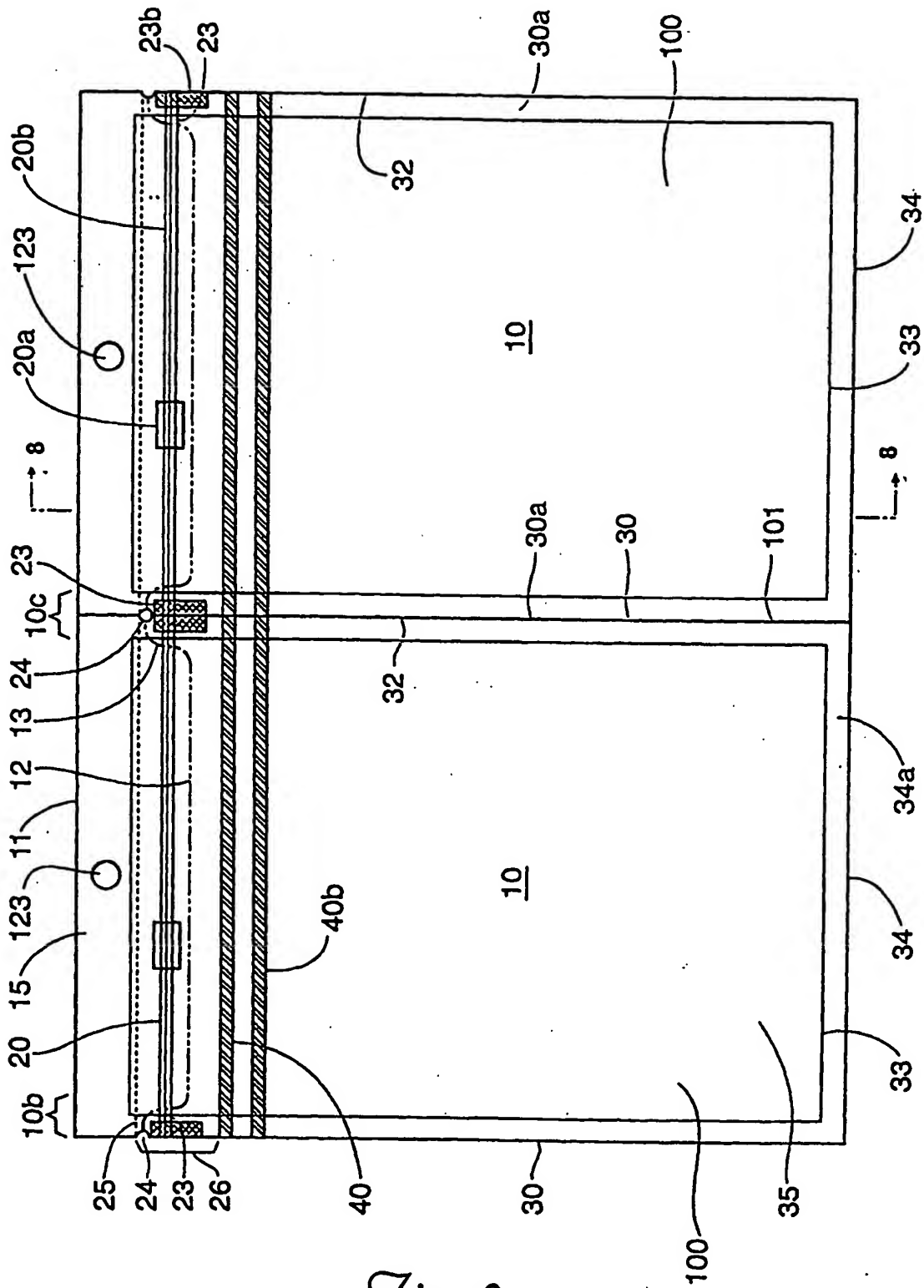
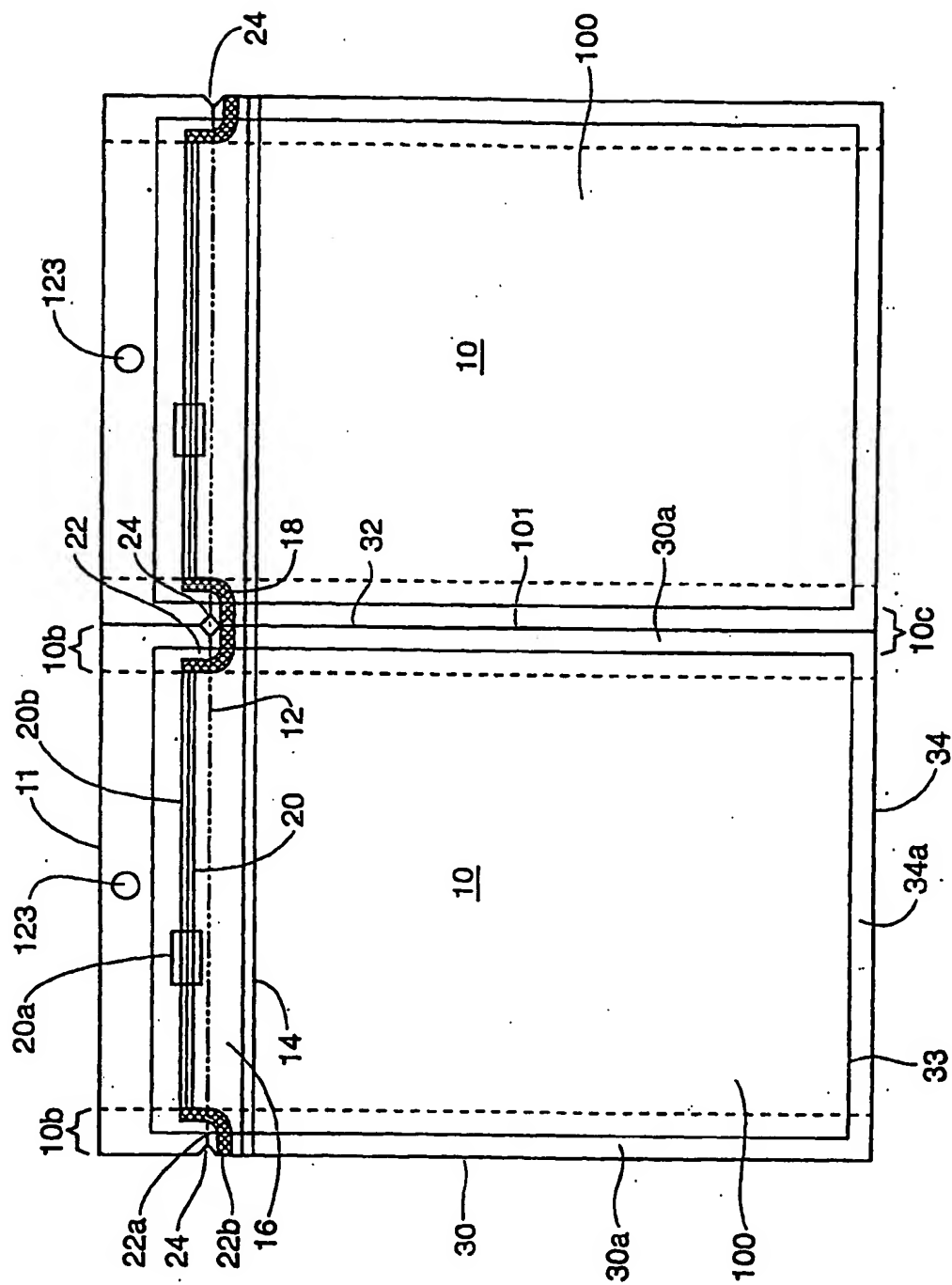
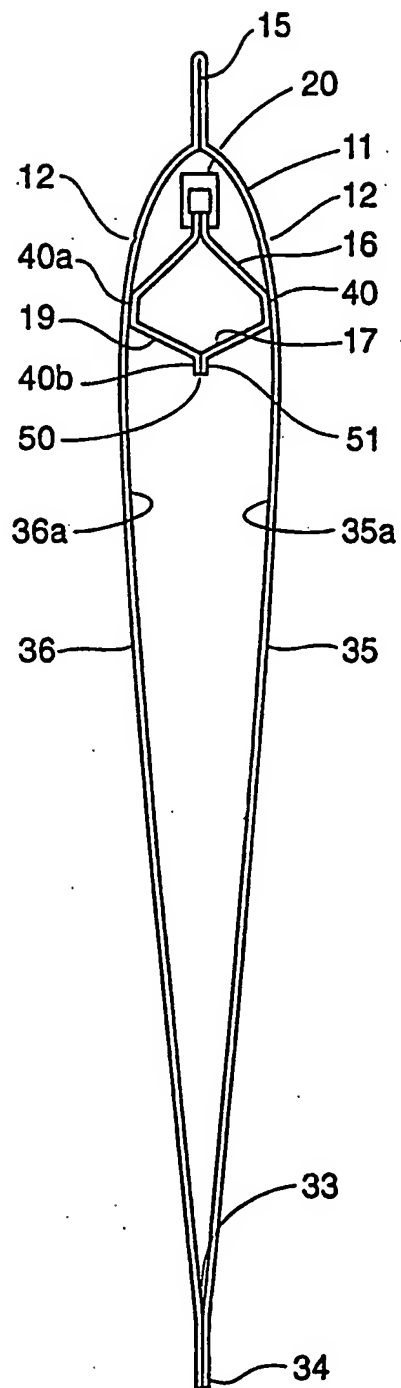
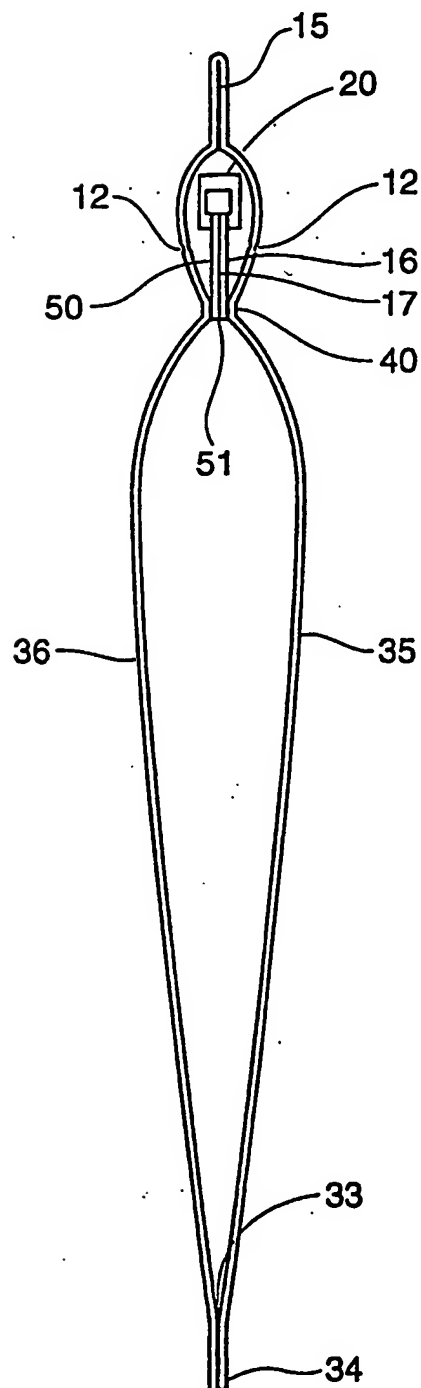
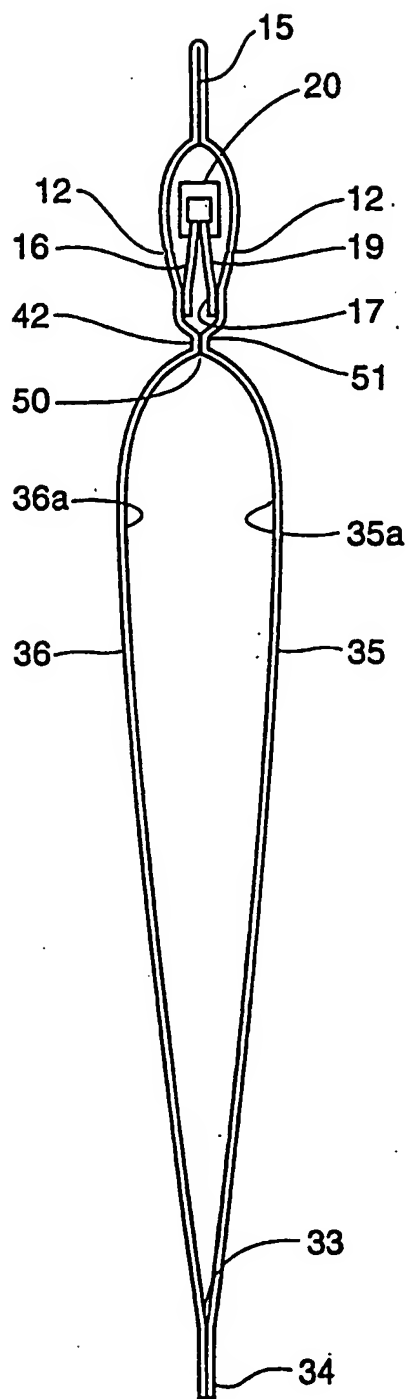
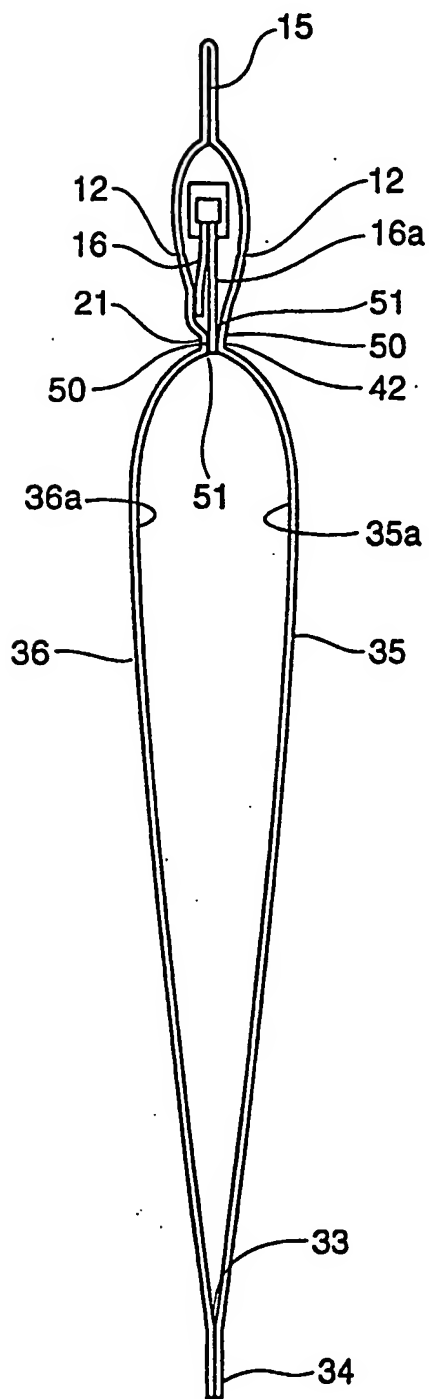


Fig. 6



*Fig. 8**Fig. 9*

*Fig. 10**Fig. 13*

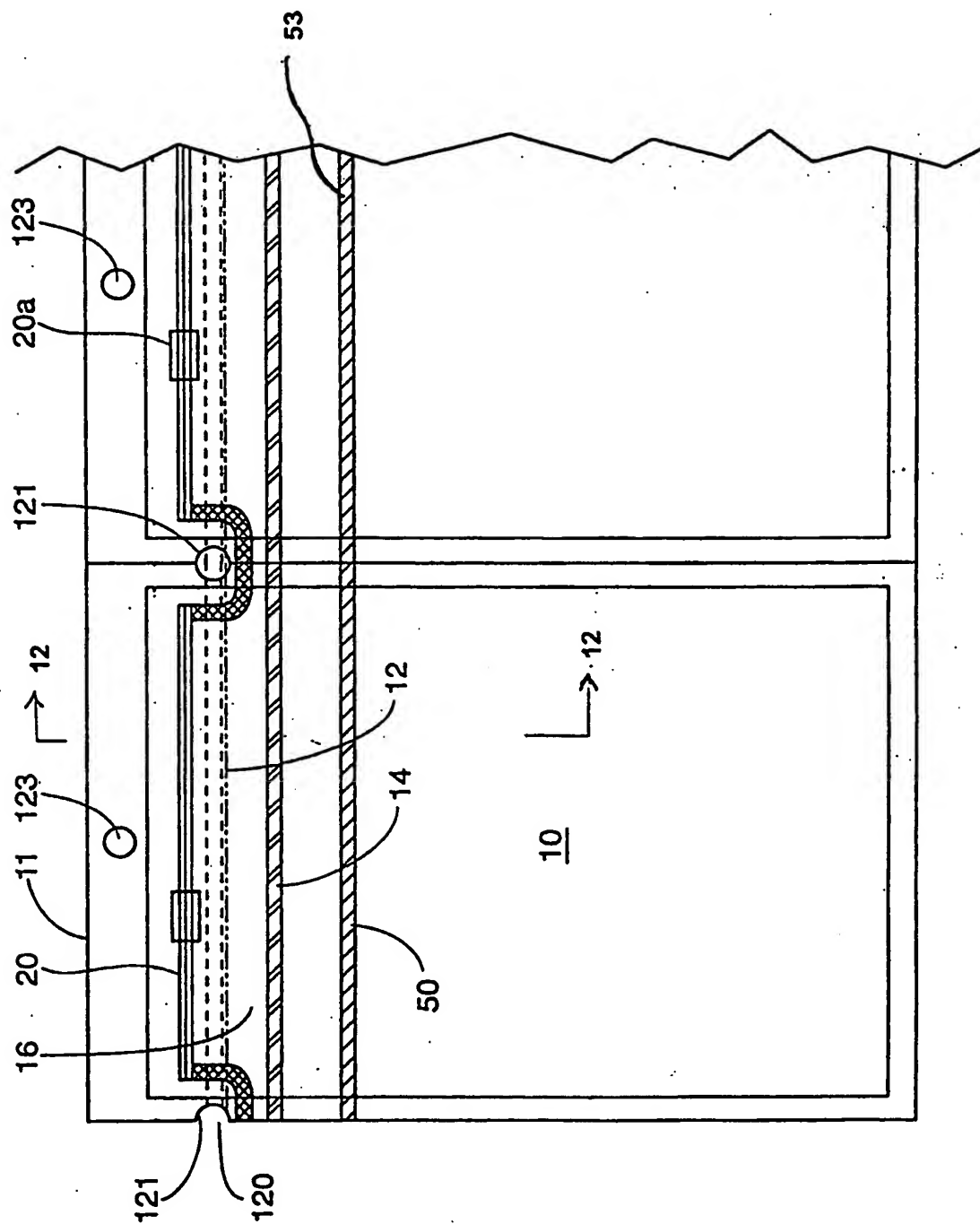


Fig. 11

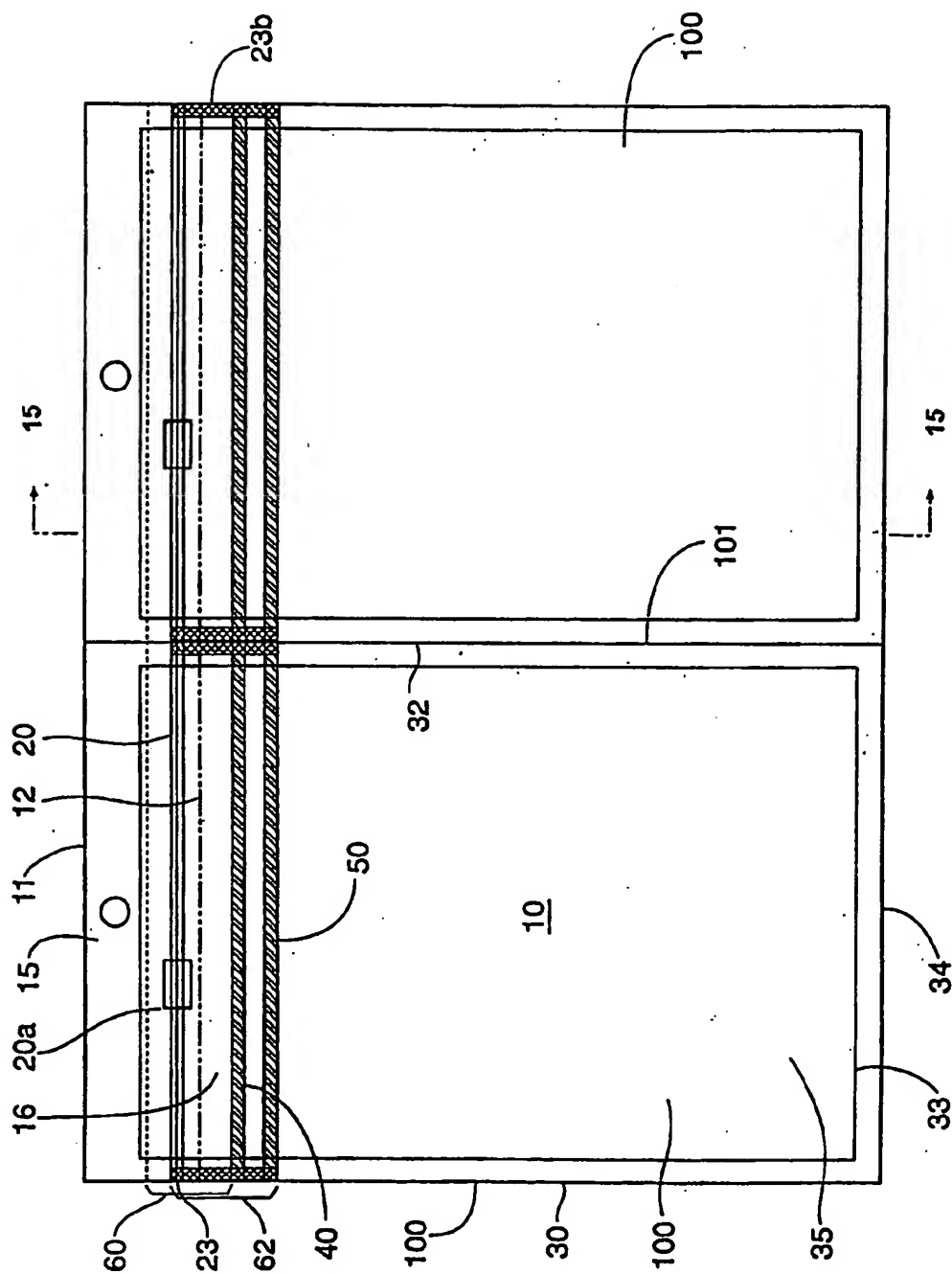


Fig. 14

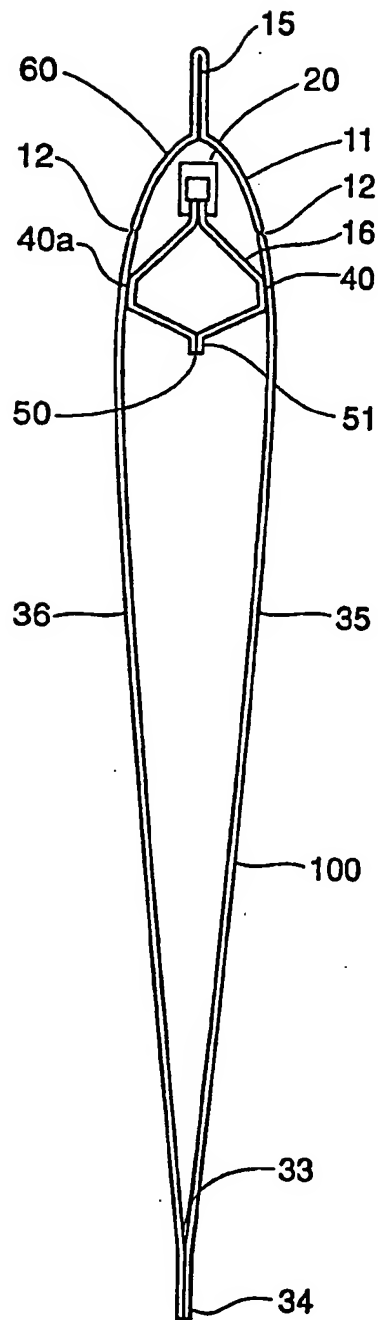


Fig. 15

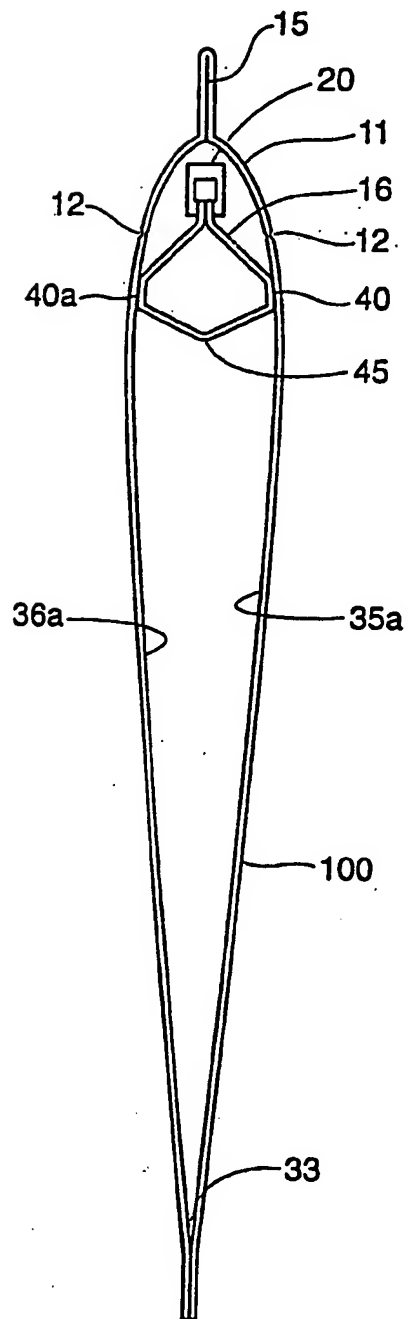
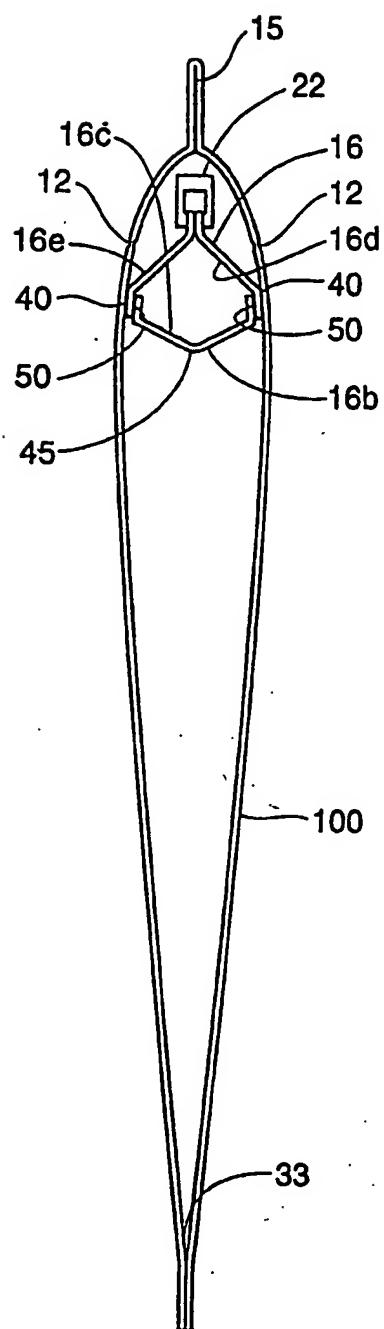
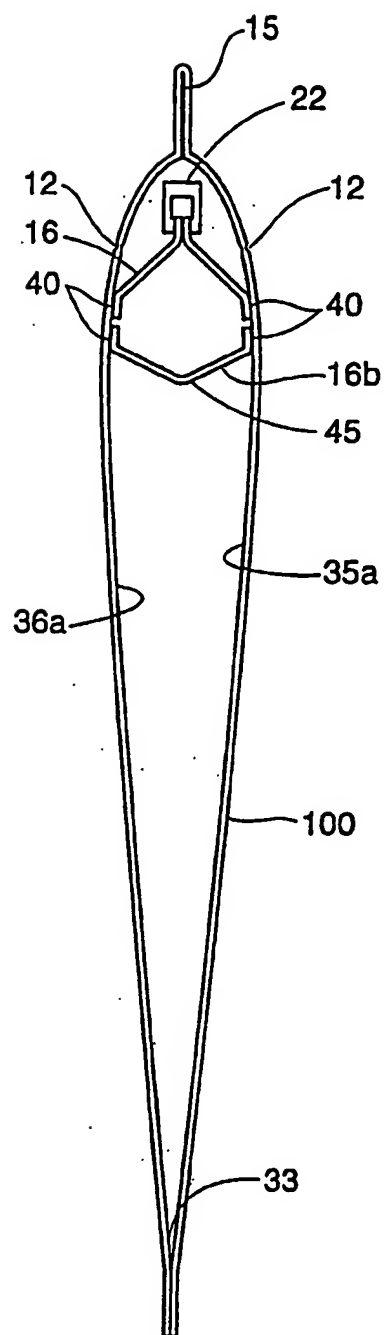


Fig. 16

*Fig. 17**Fig. 18*

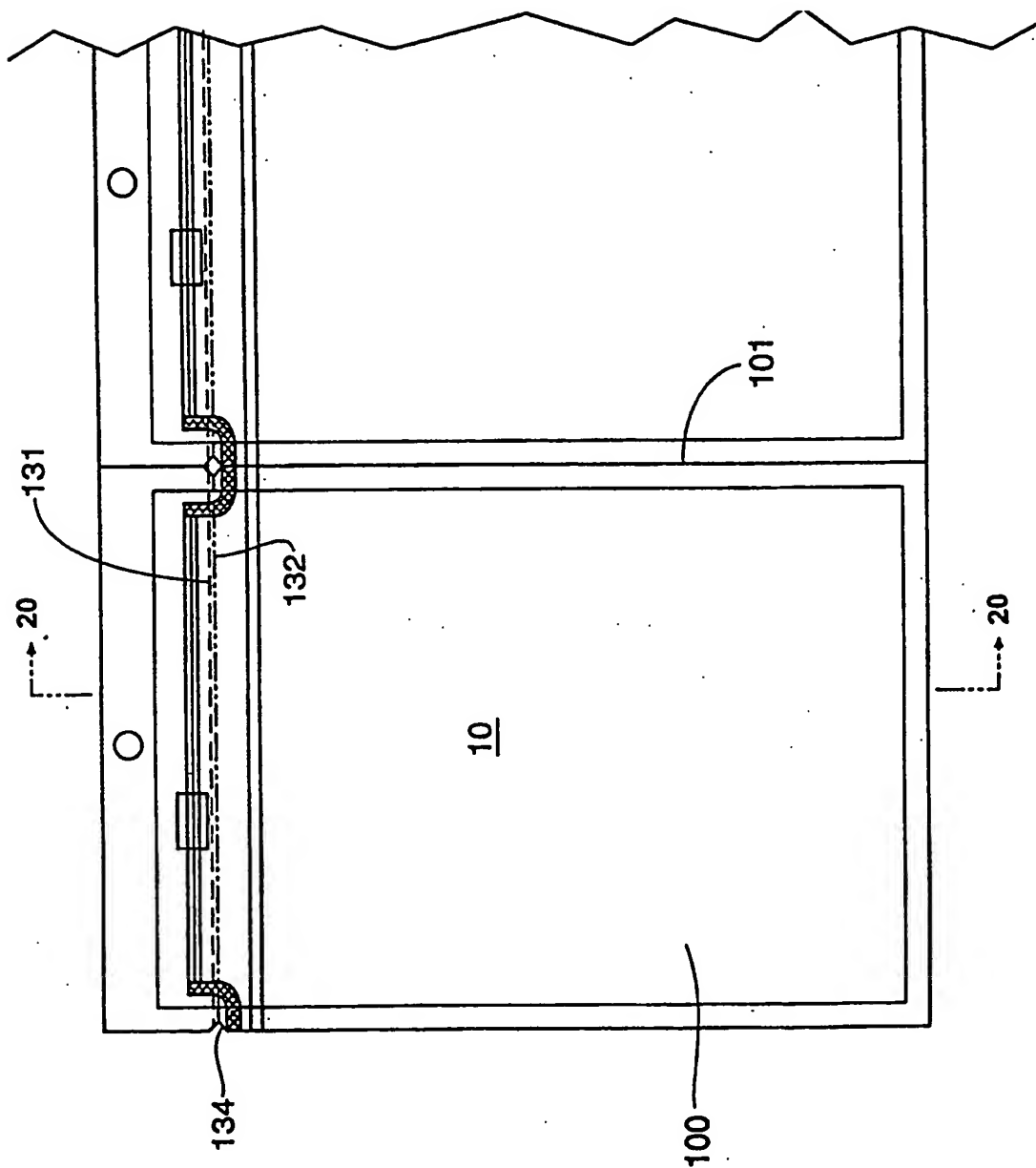
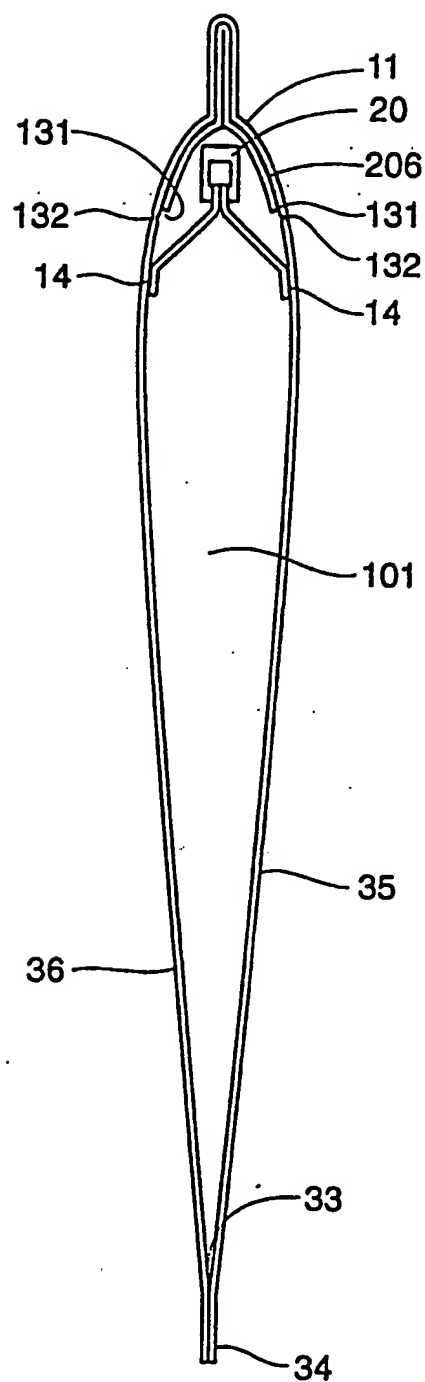


Fig. 19

*Fig. 20*

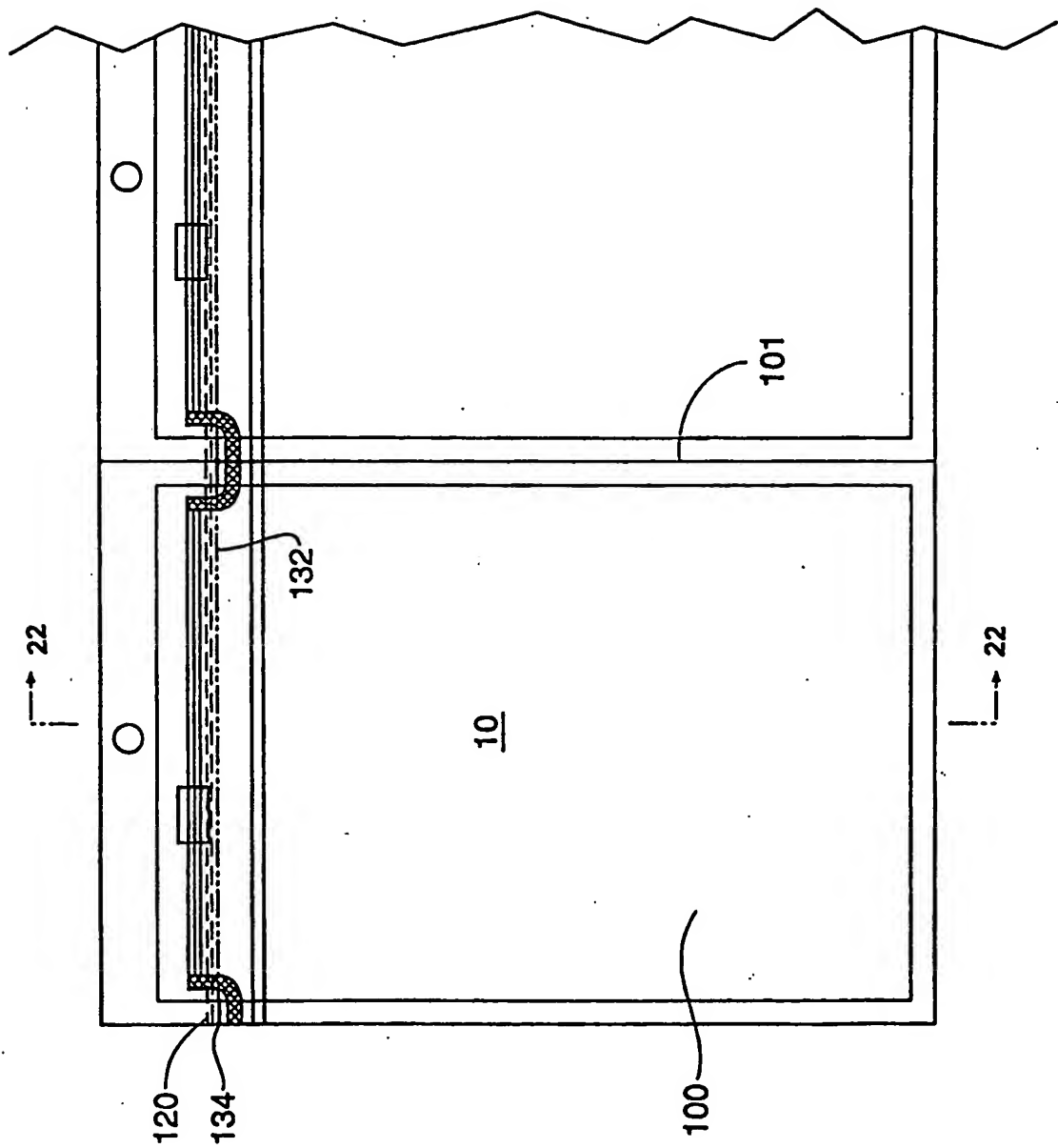


Fig. 21

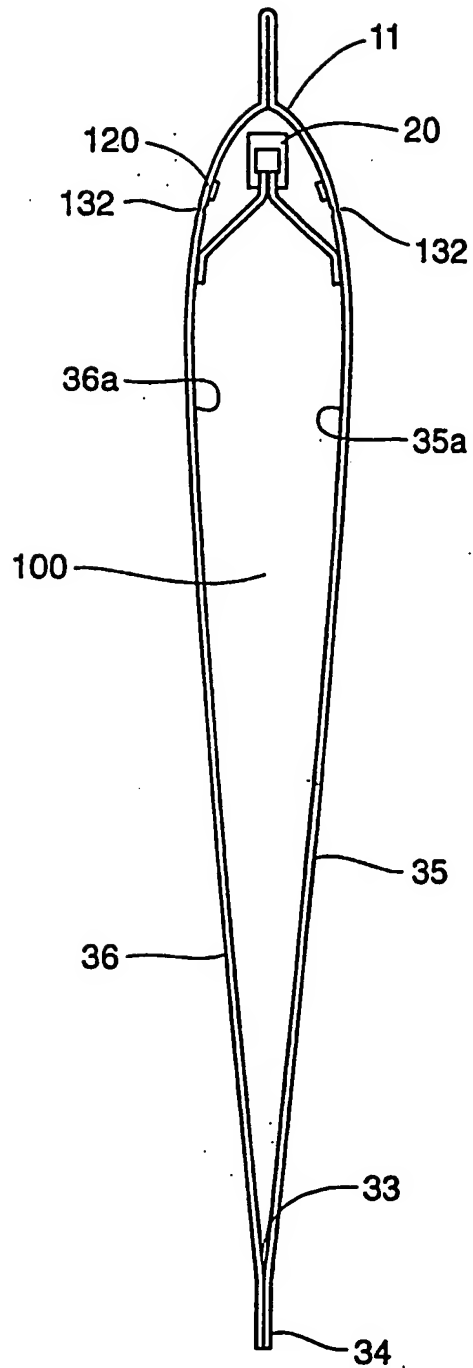


Fig. 22

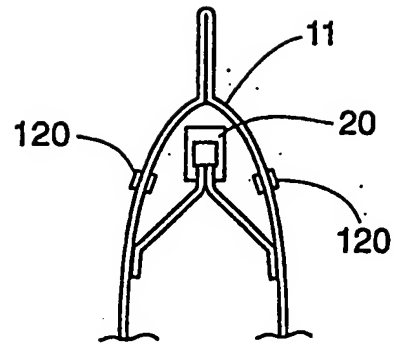


Fig. 23

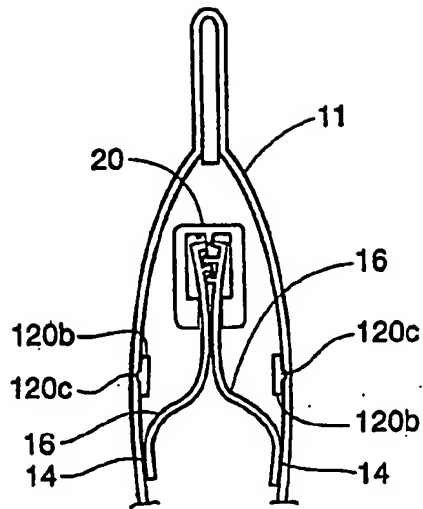


Fig. 24

Fig. 25

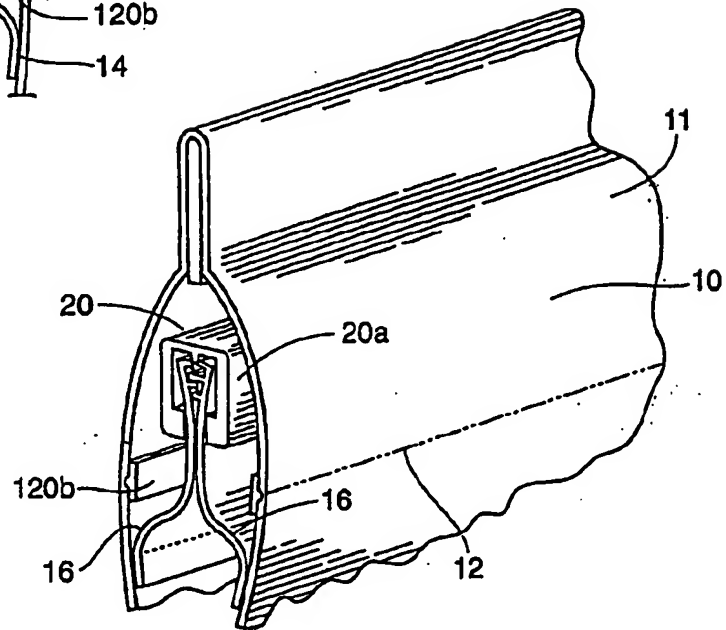
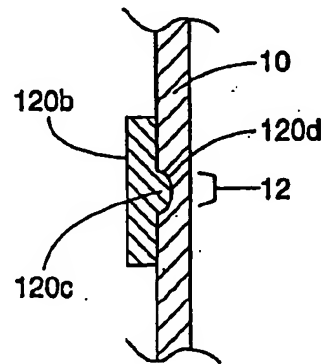
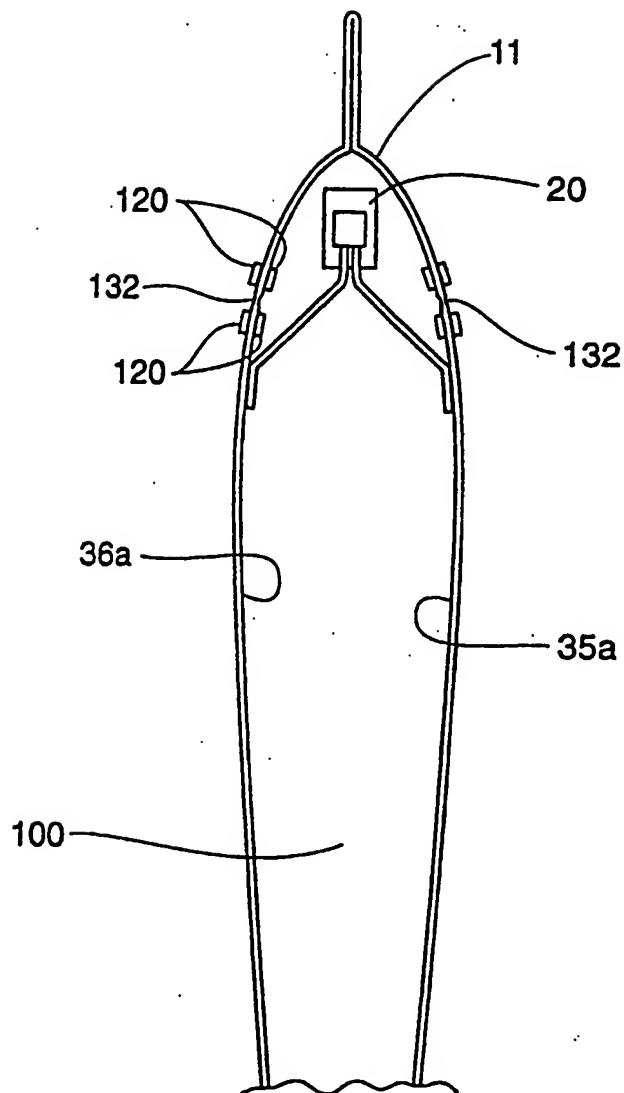


Fig. 26



*Fig. 27*

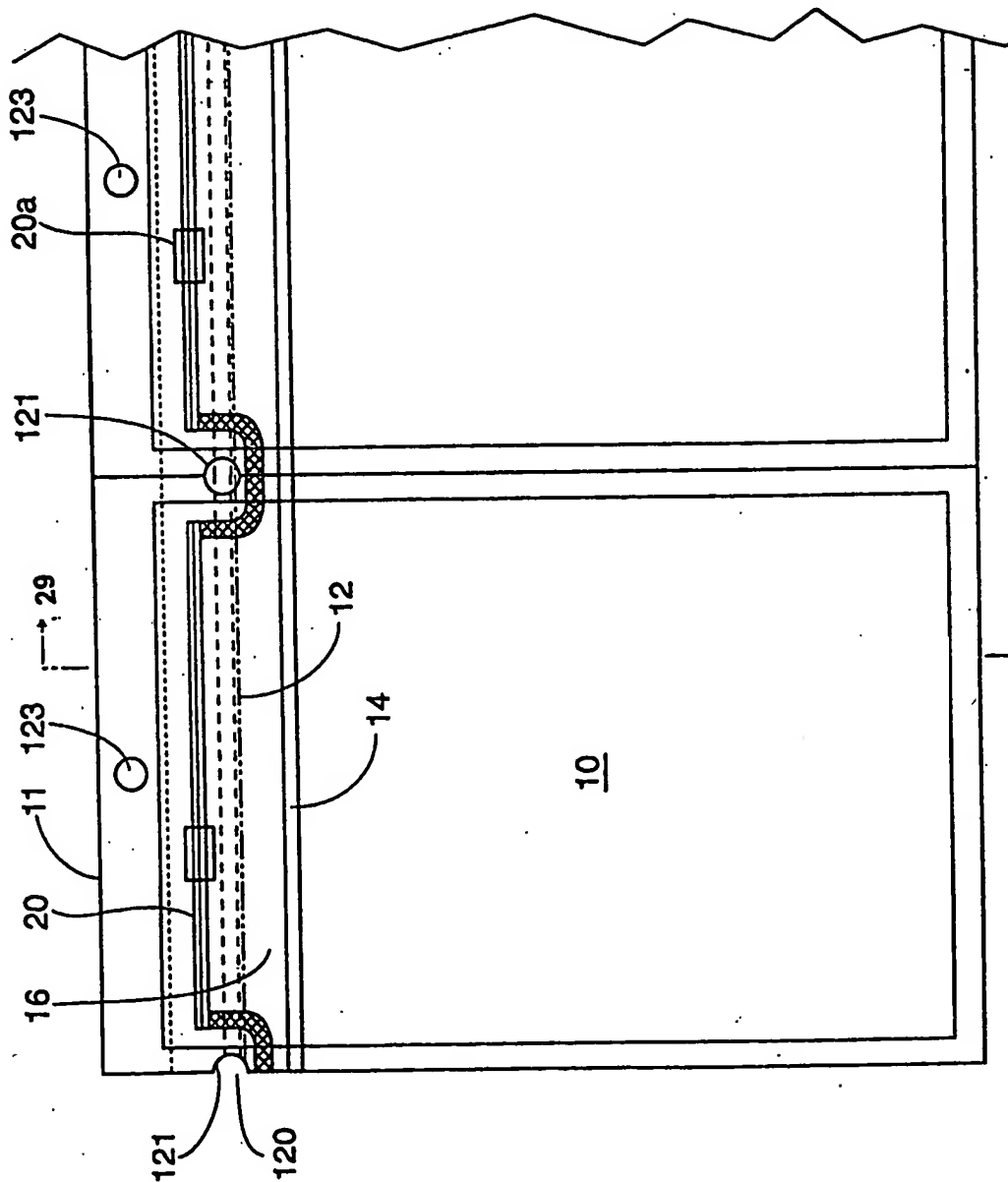
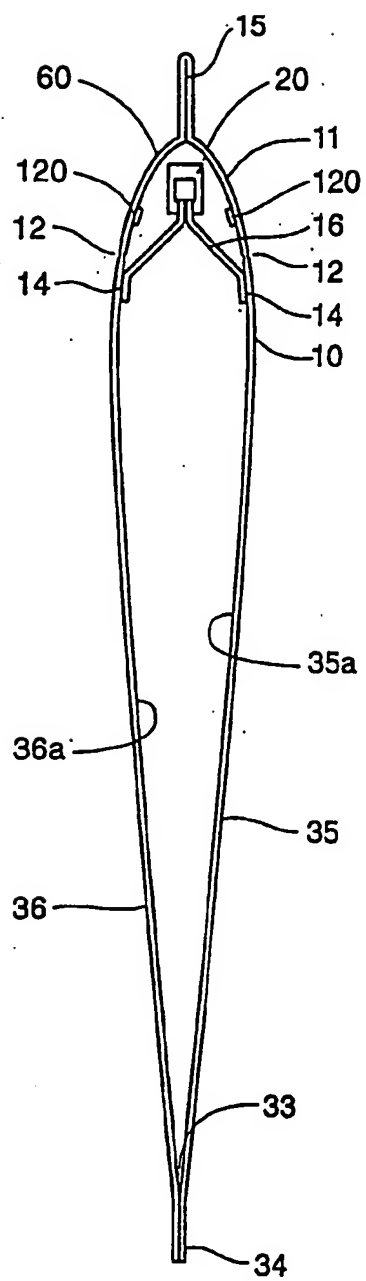


Fig. 28

*Fig. 29*

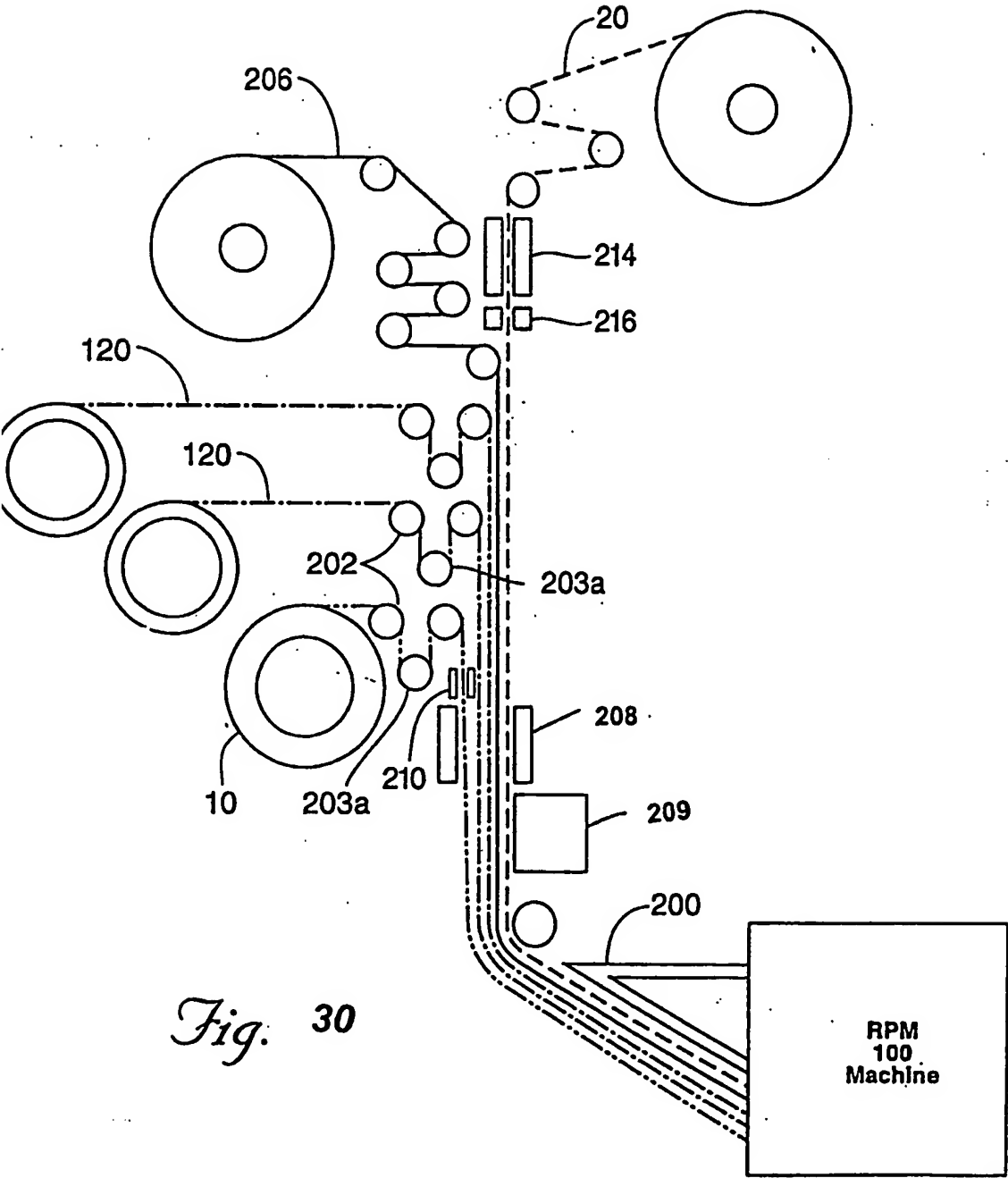
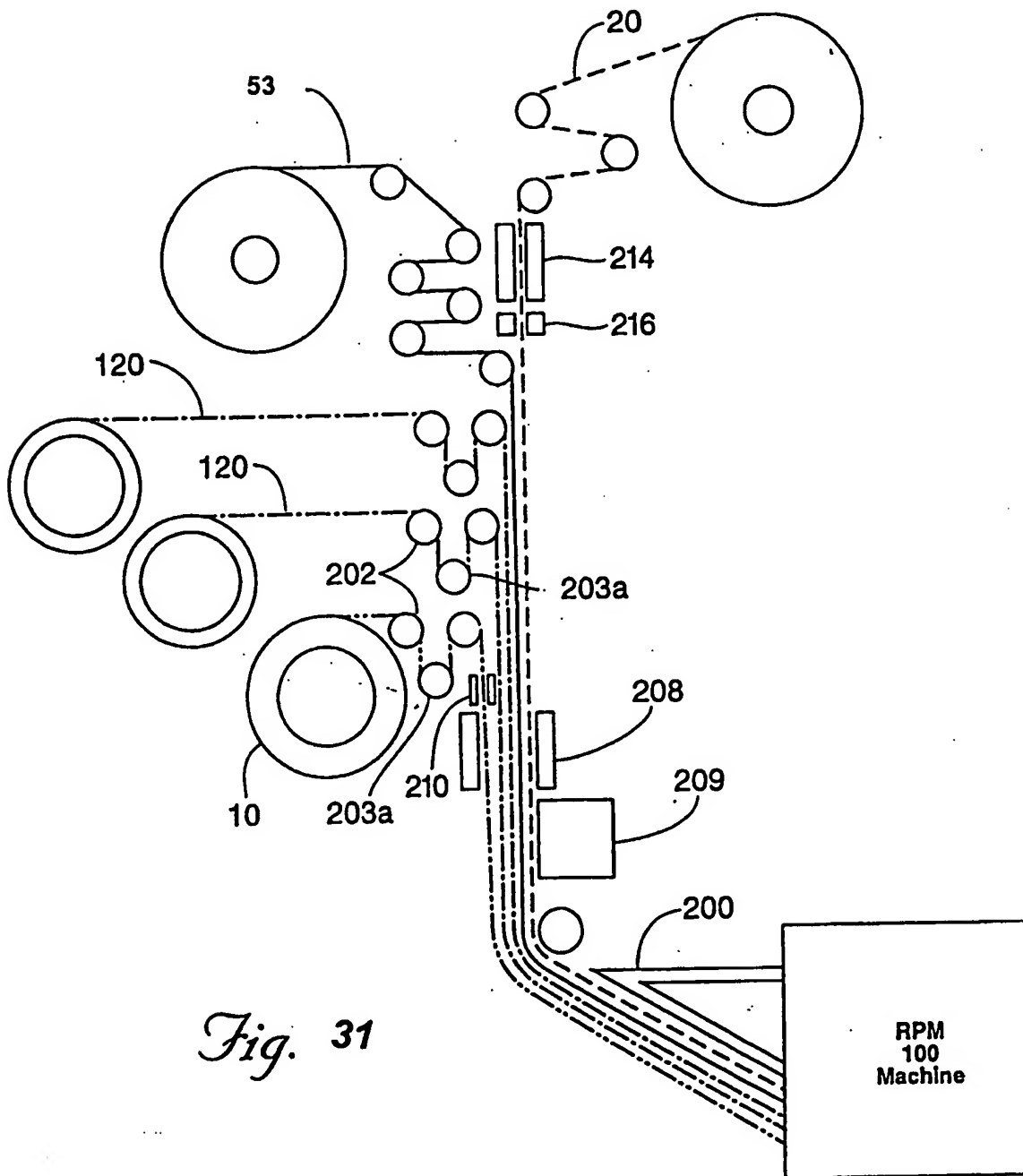
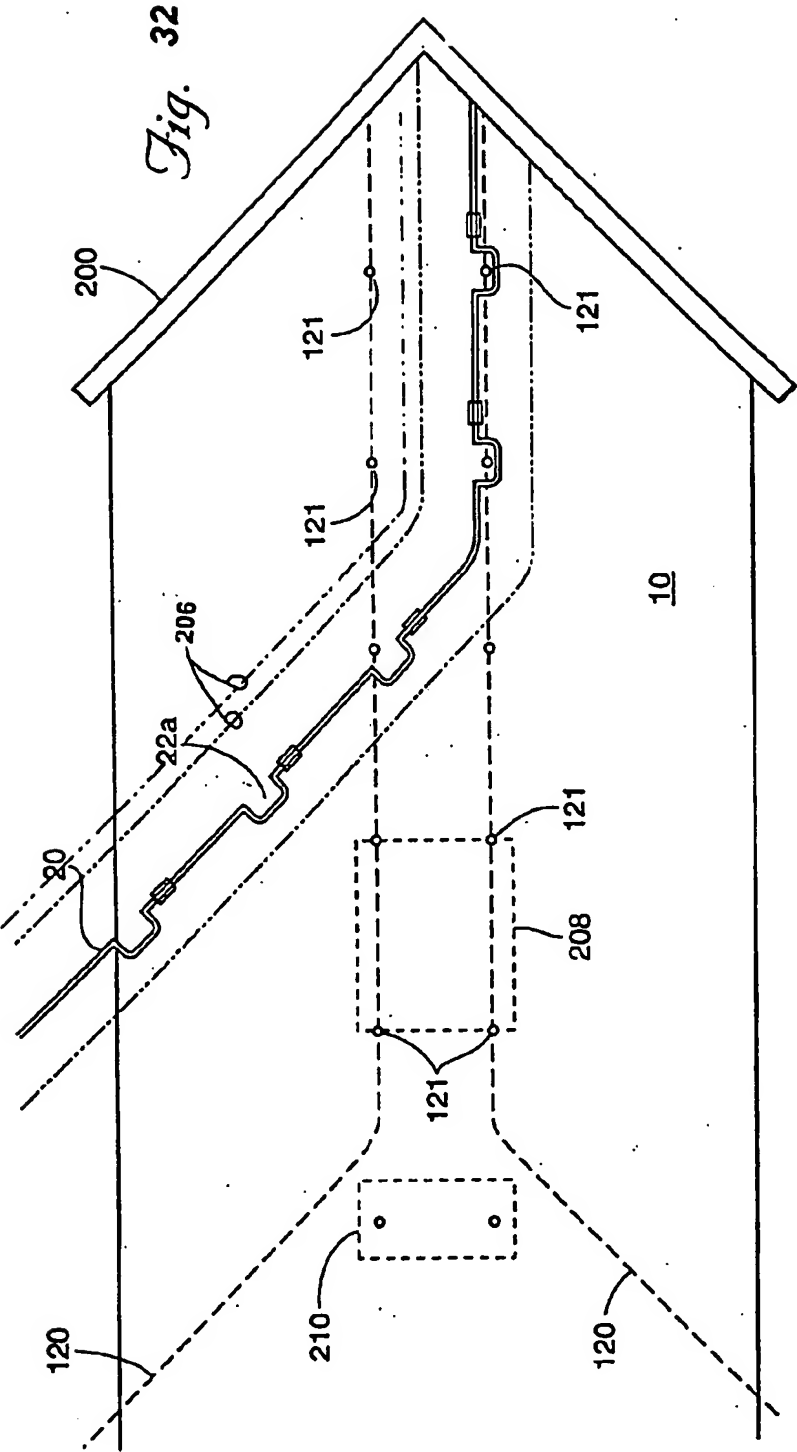
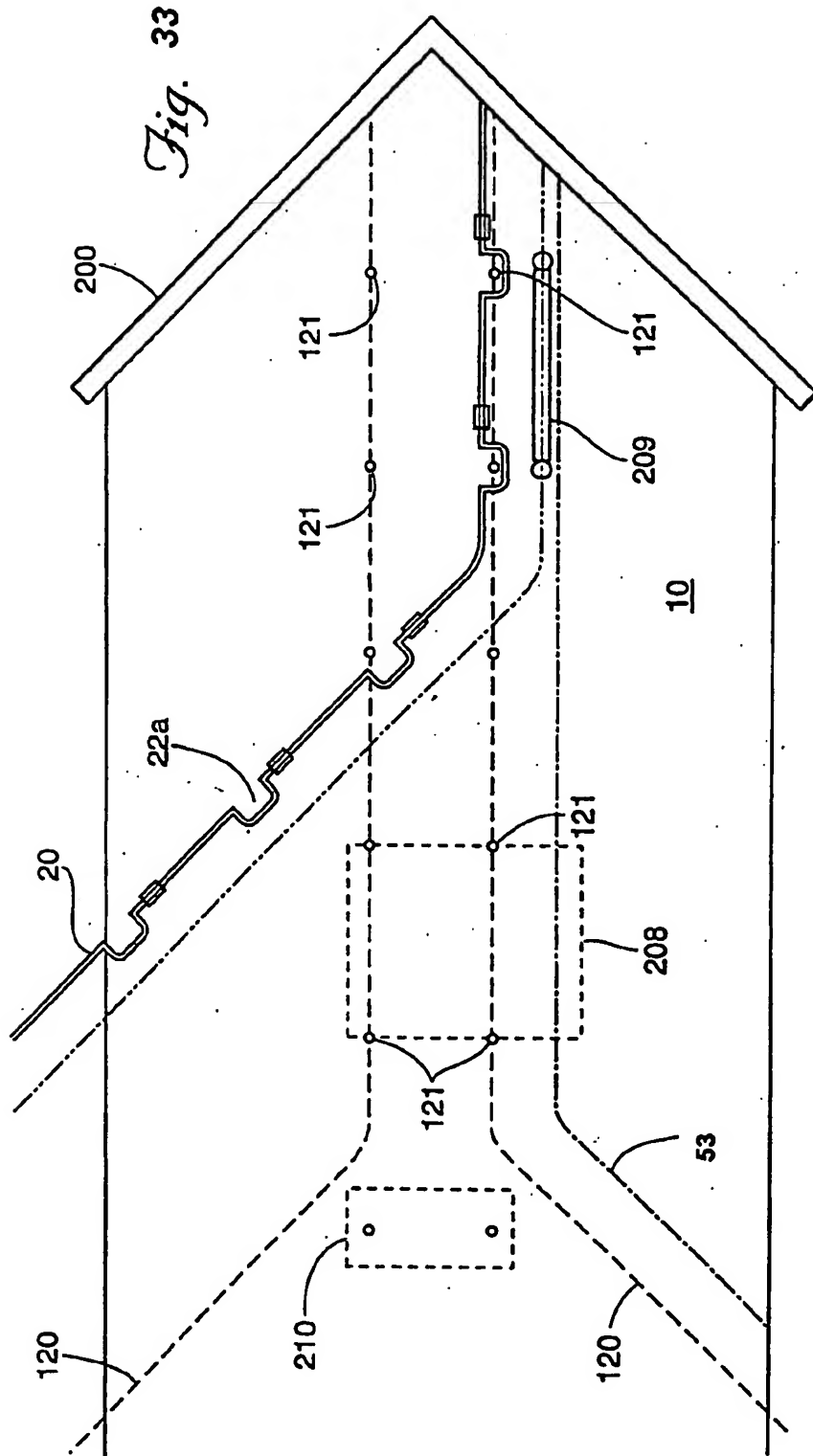
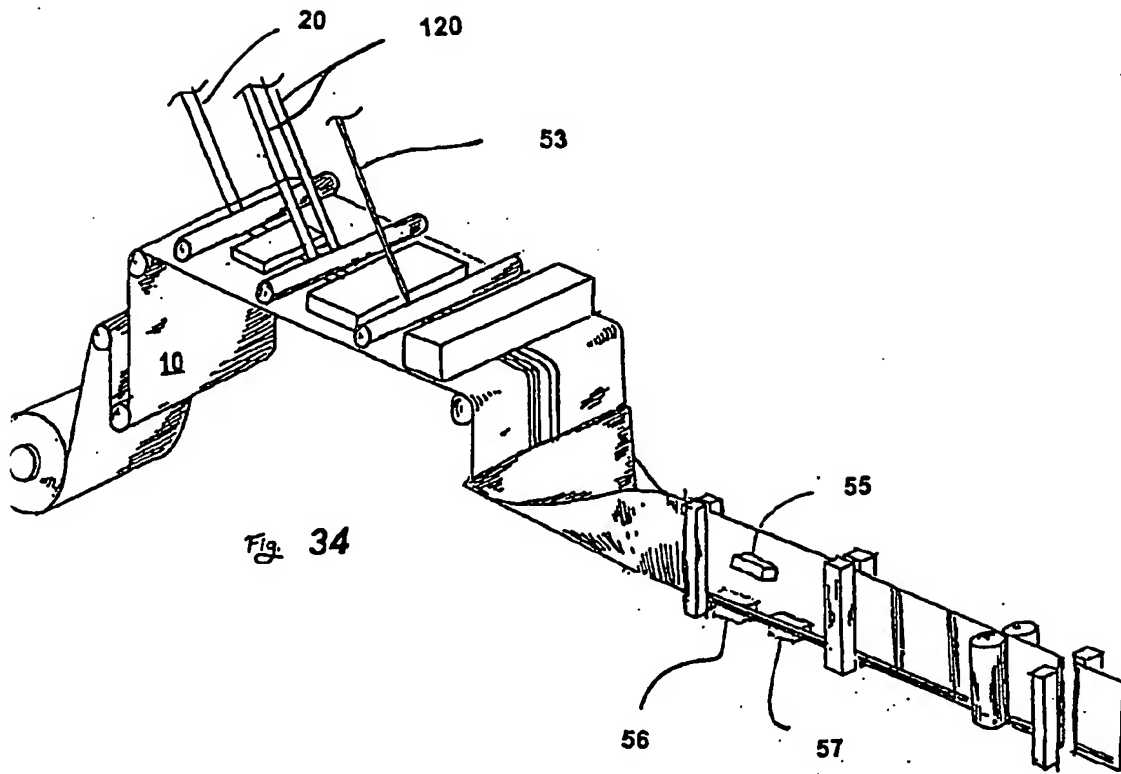


Fig. 30









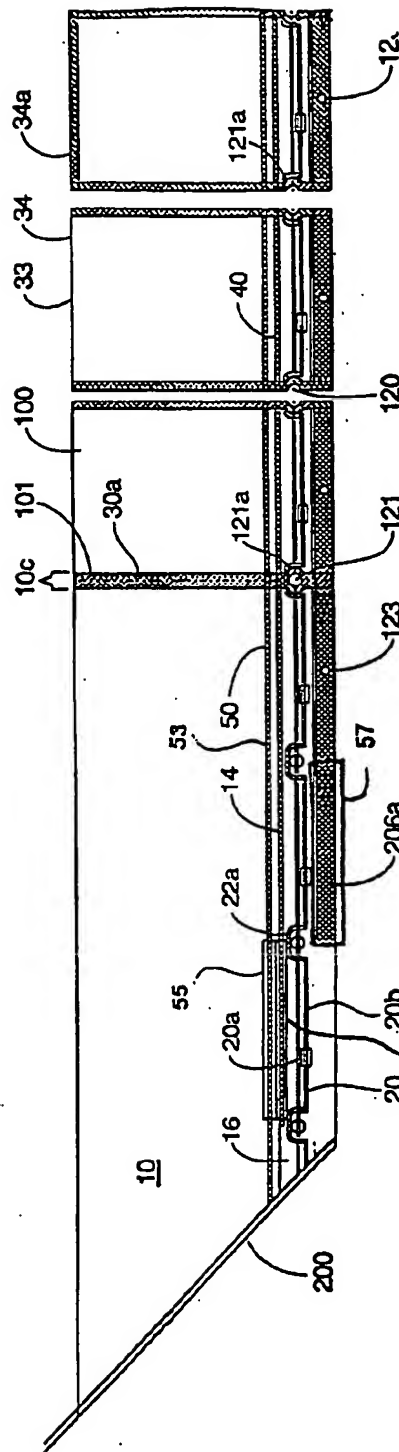


Fig. 36

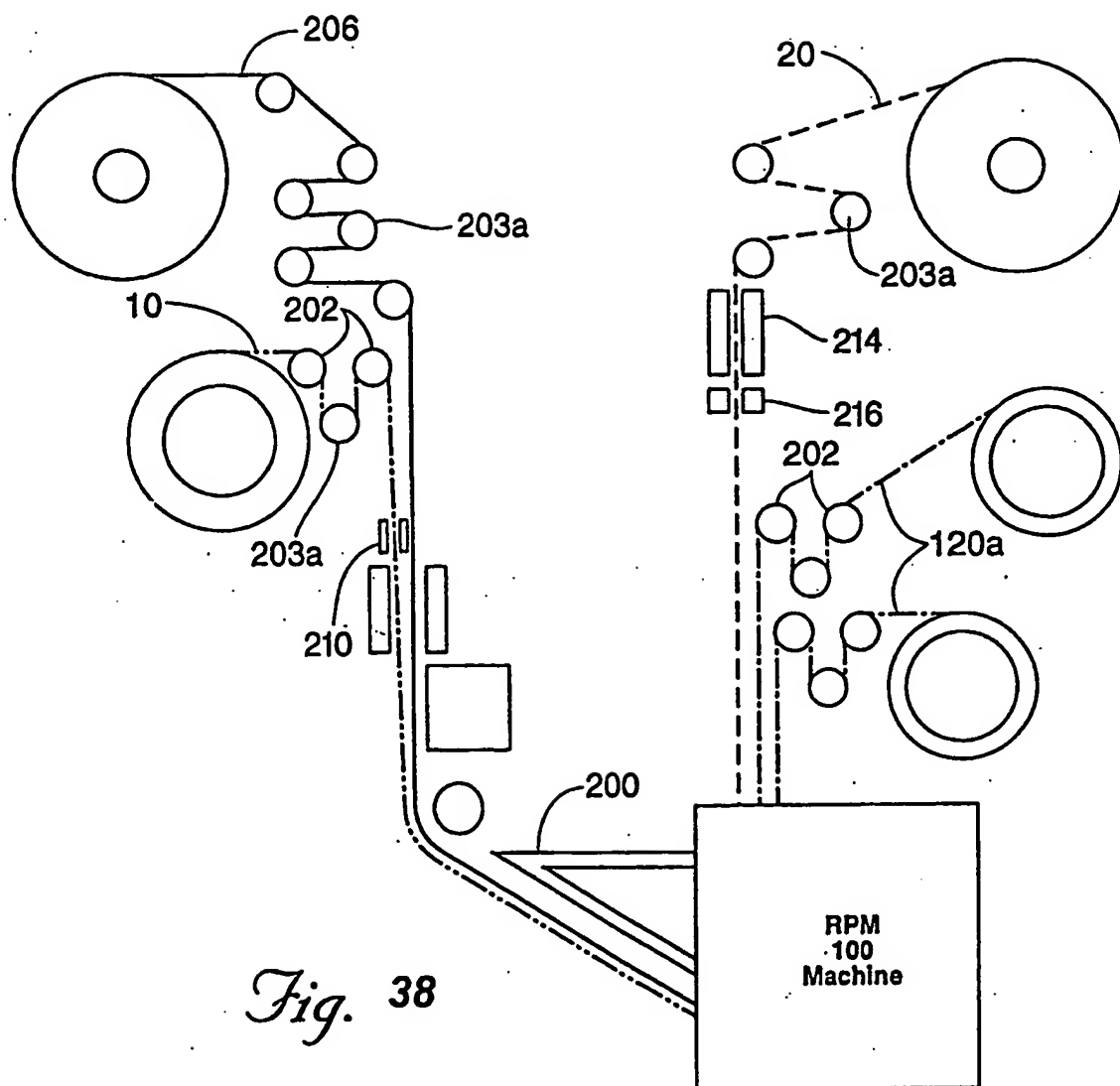


Fig. 38

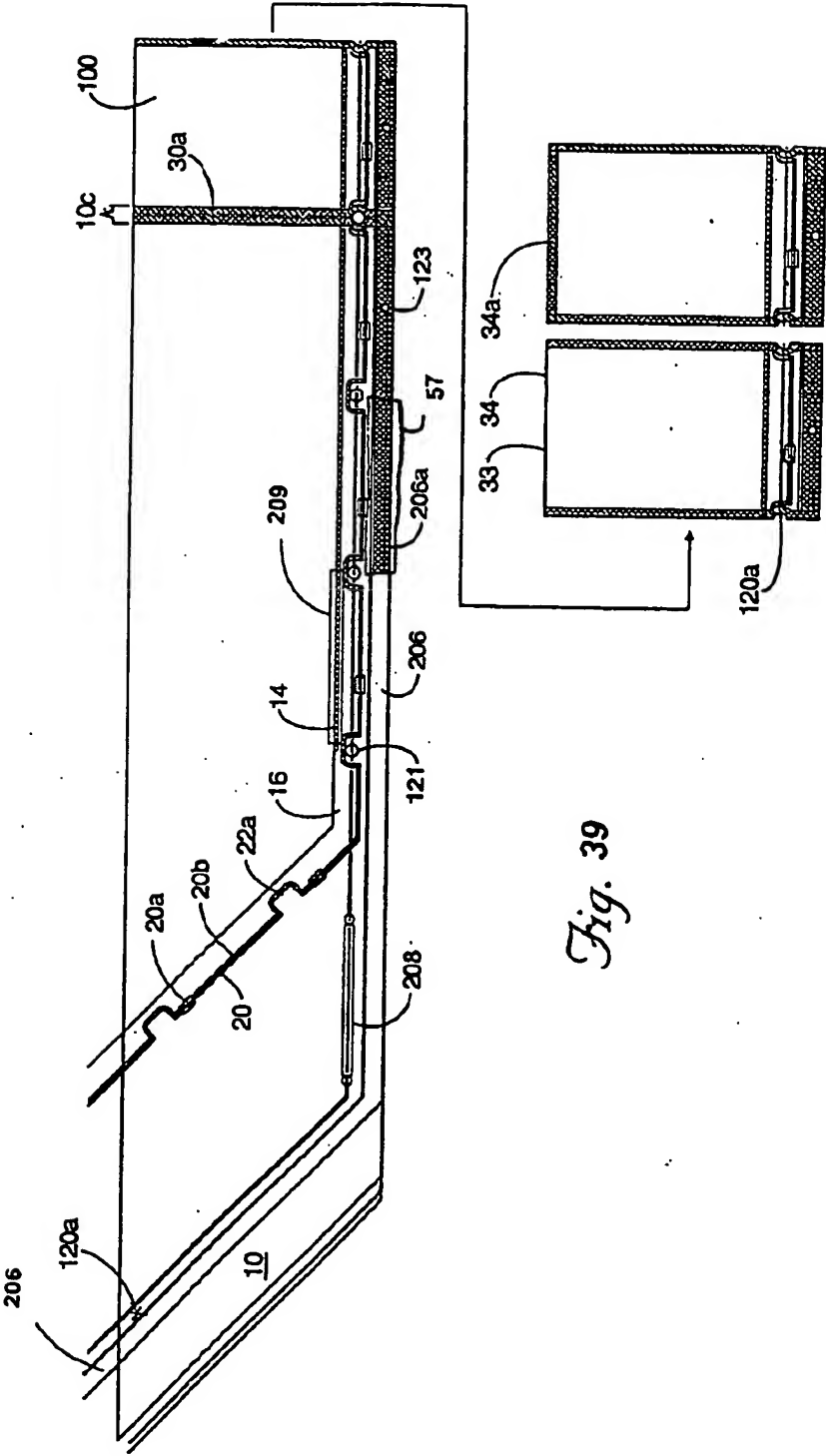


Fig. 39

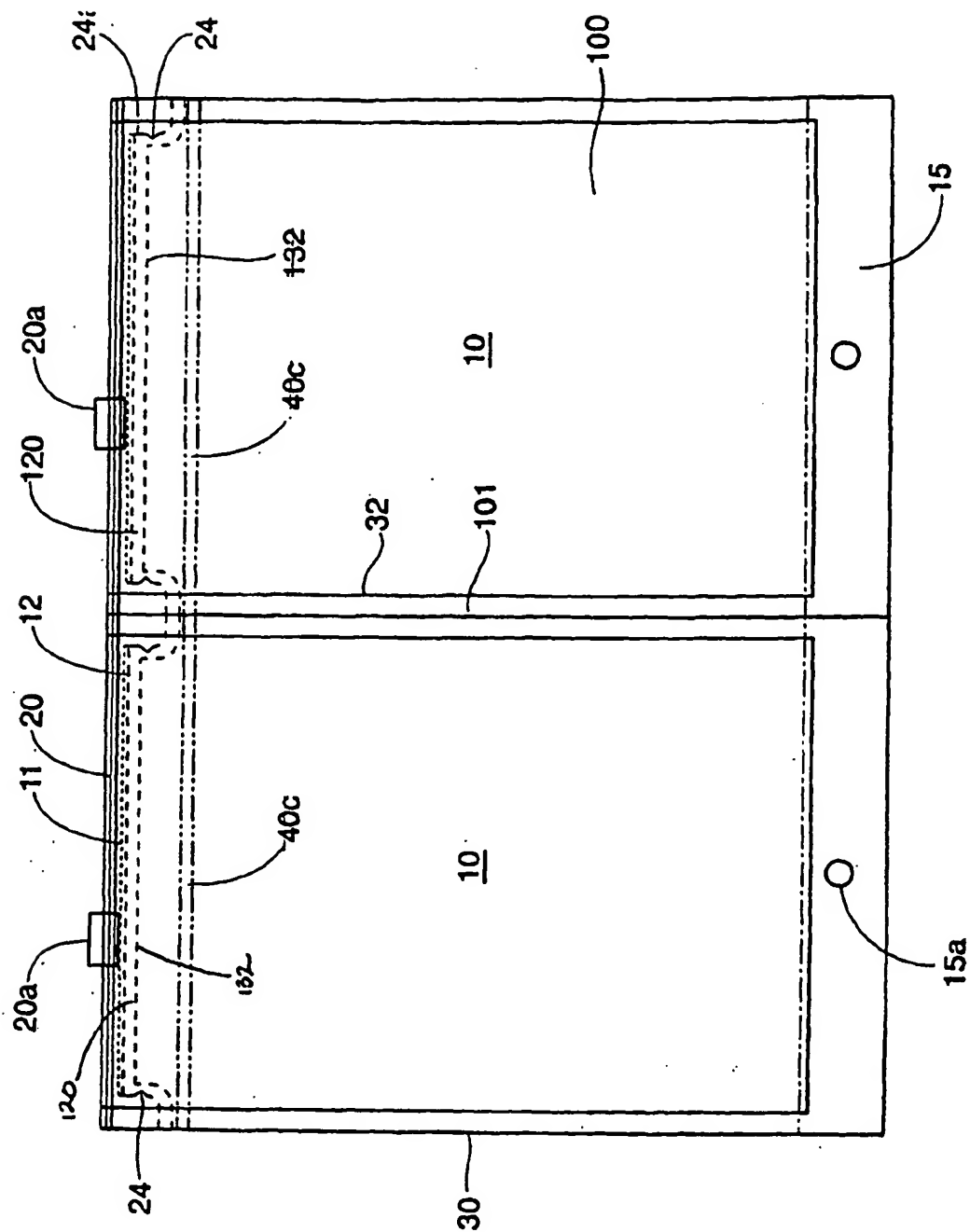


Fig. 40

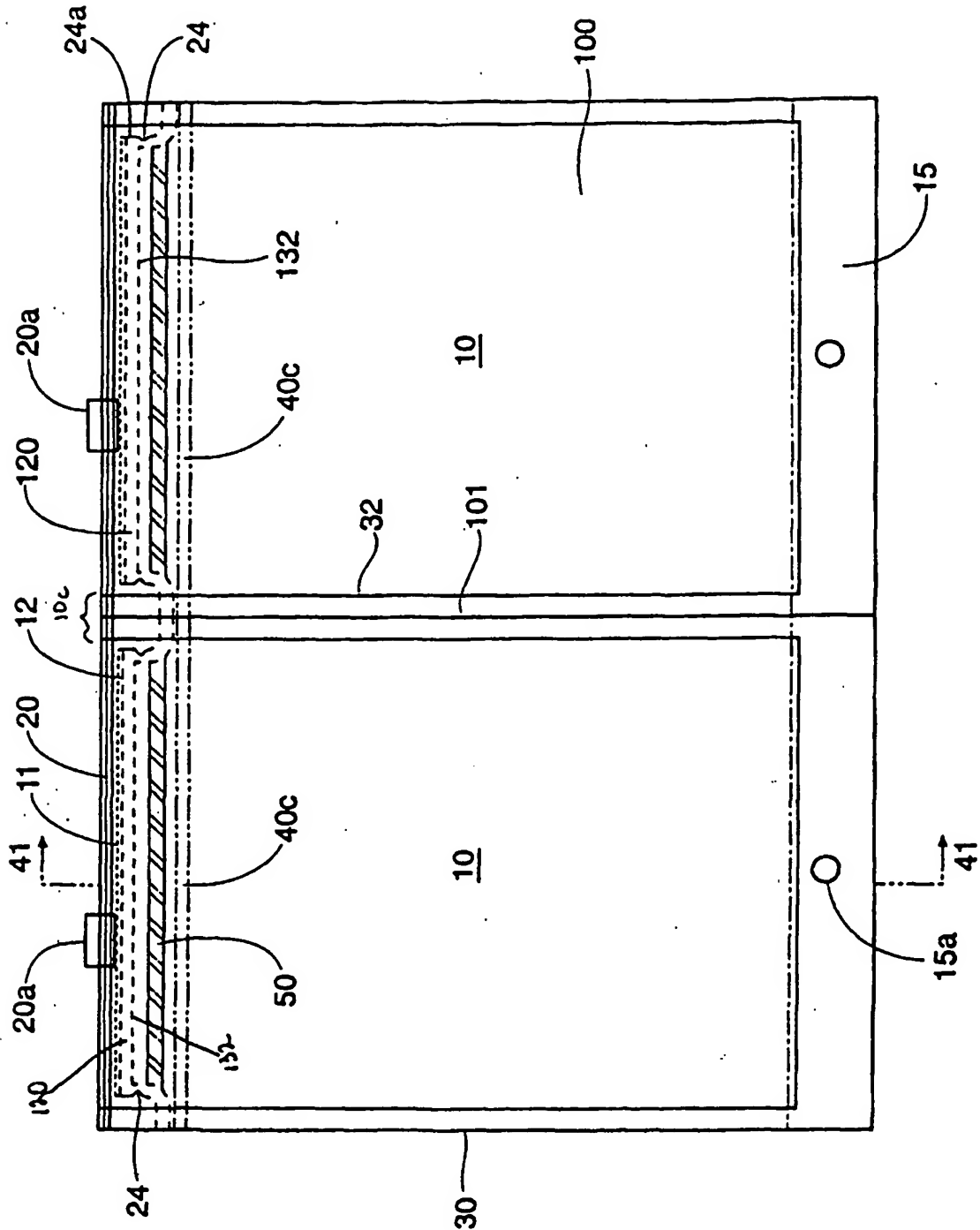
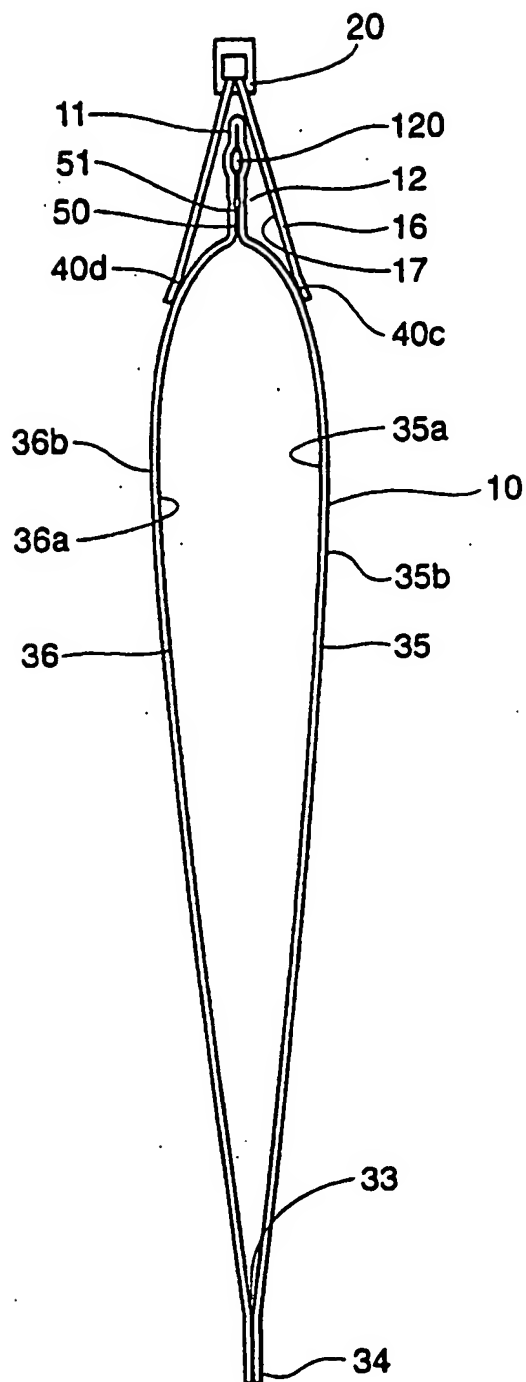
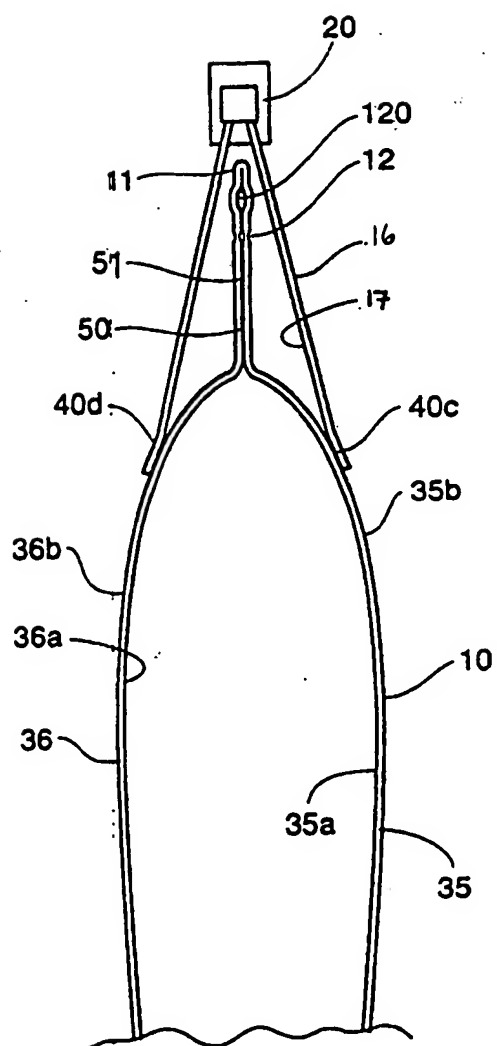


Fig. 40a

*Fig. 41**Fig. 41a*

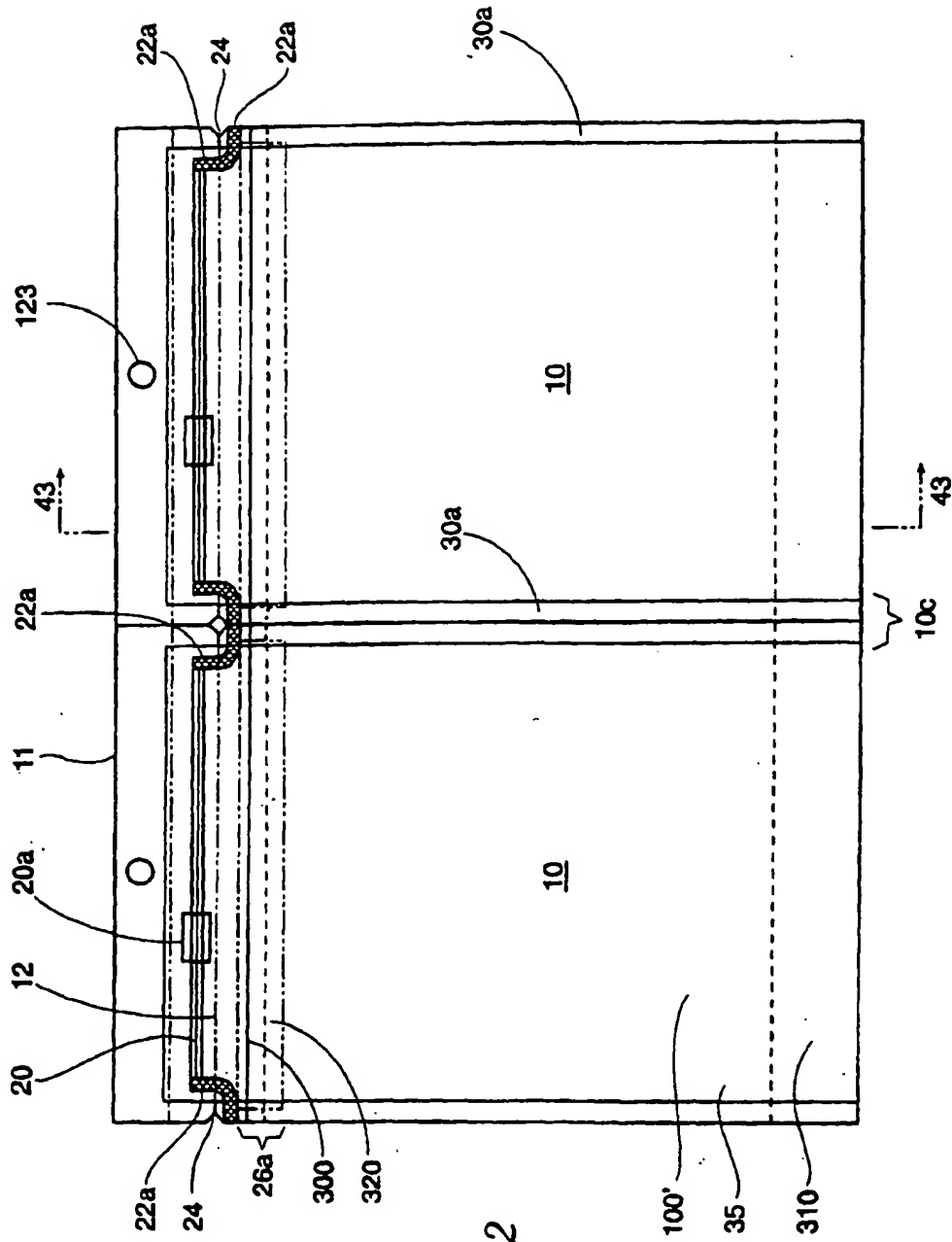


Fig. 42

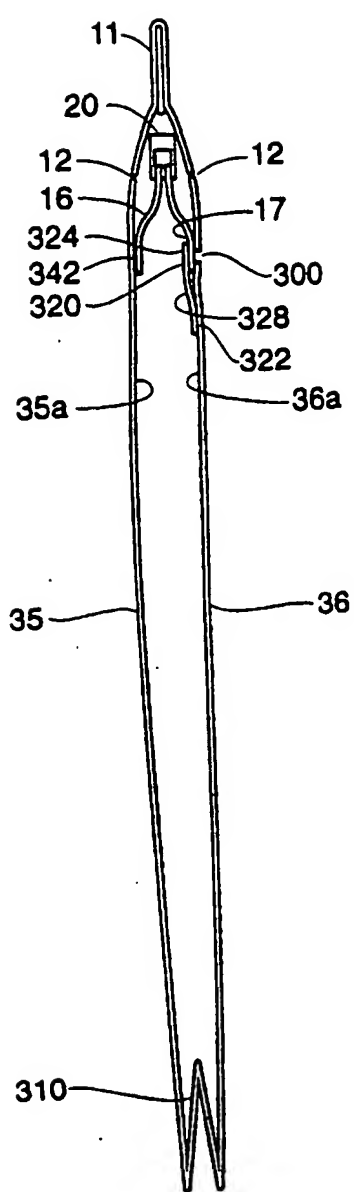


Fig. 43

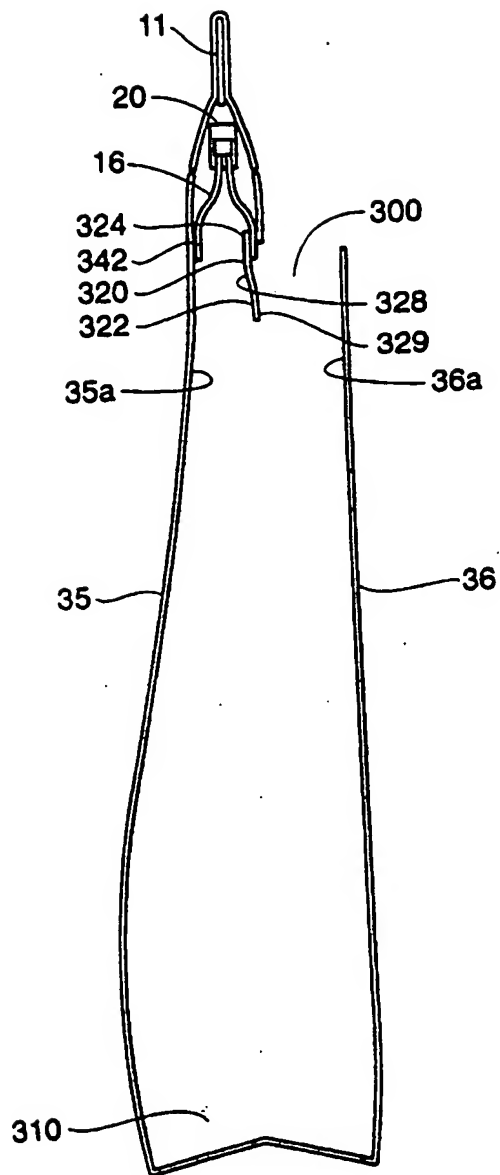
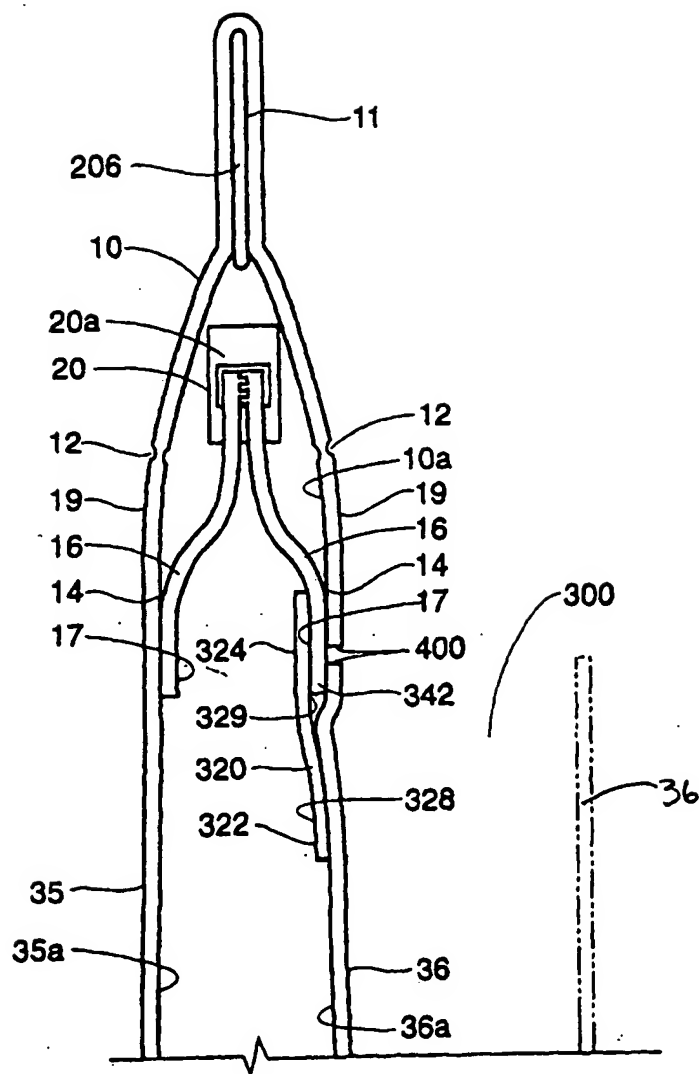


Fig. 44

*Fig. 45*

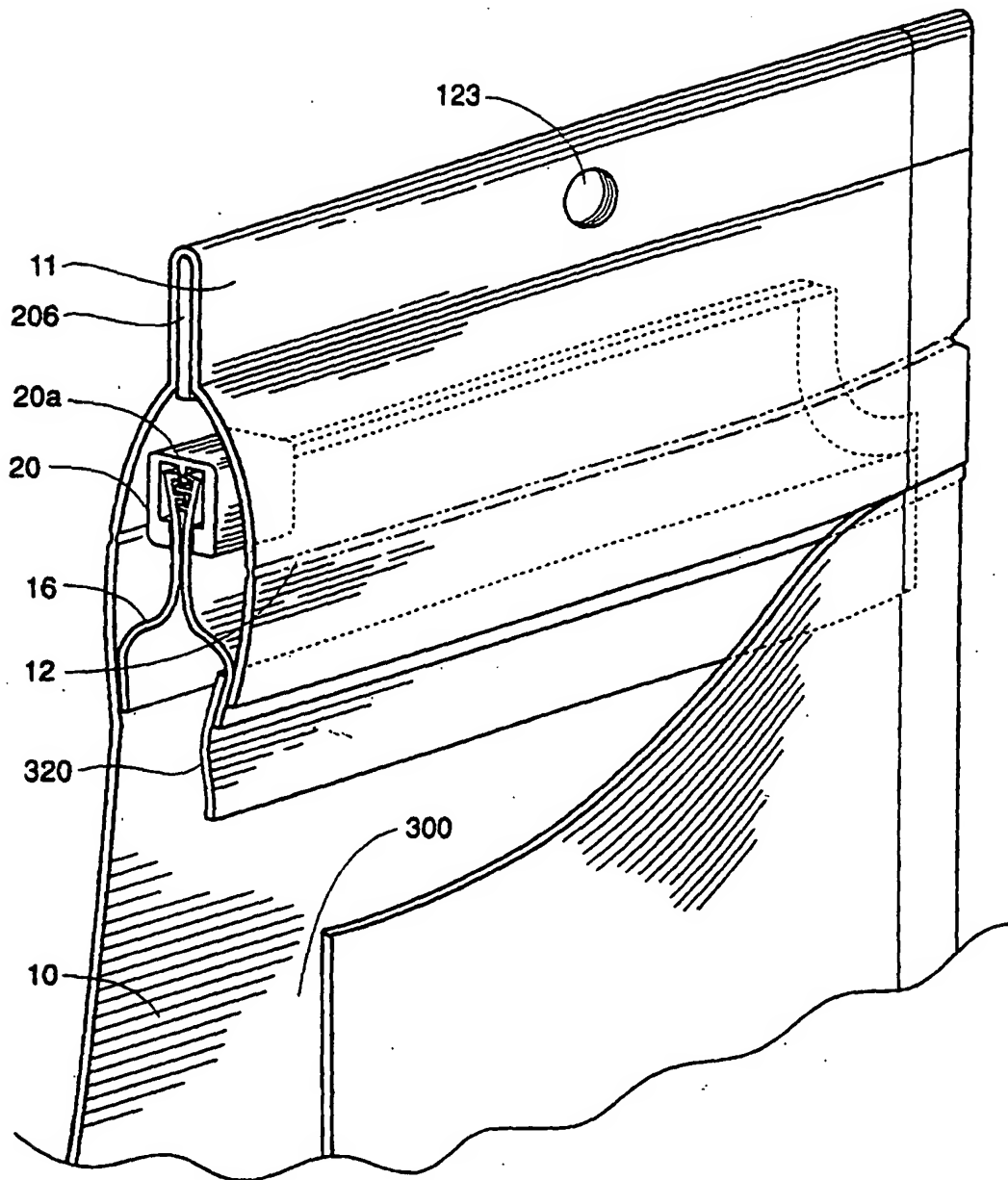


Fig. 45a

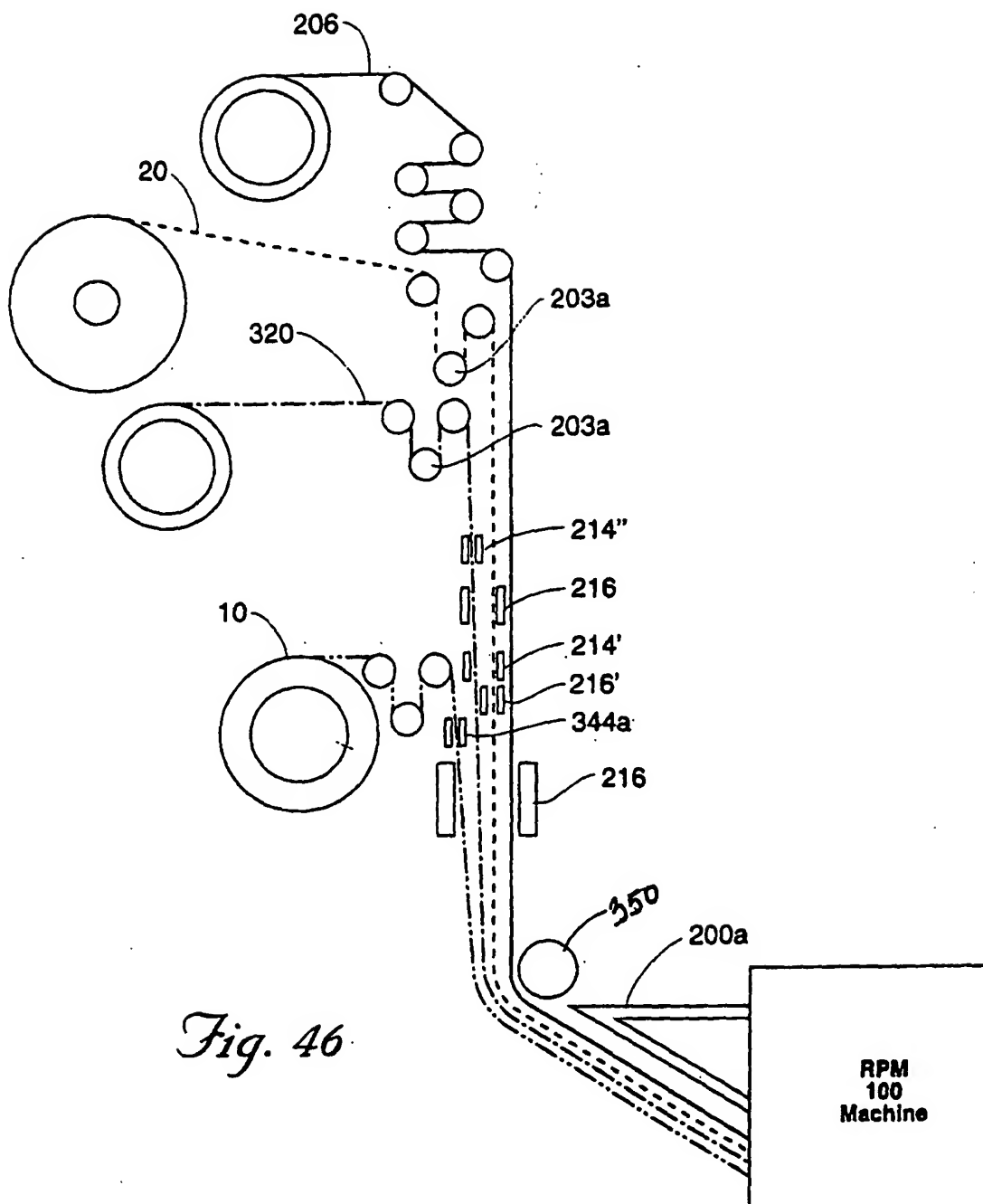


Fig. 46

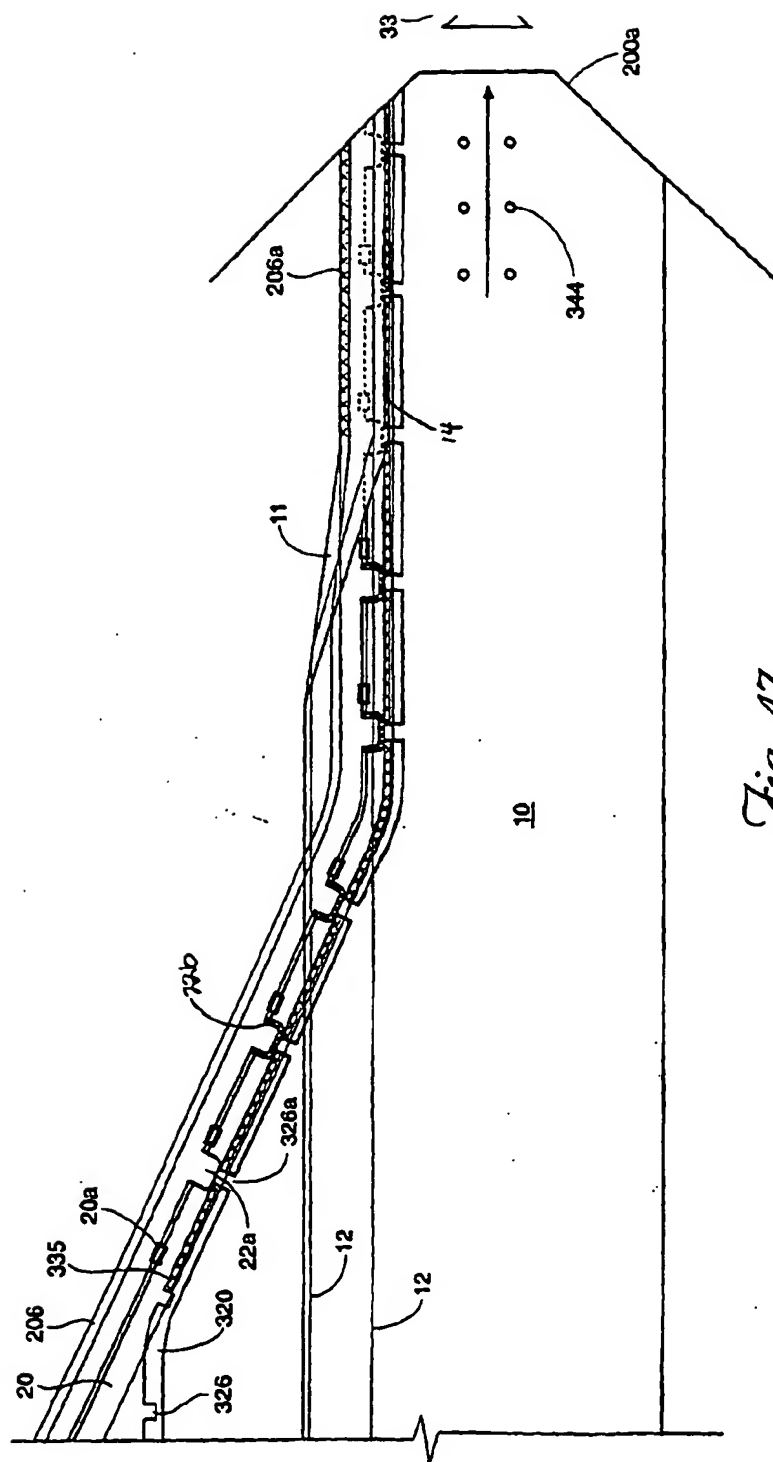


Fig. 47

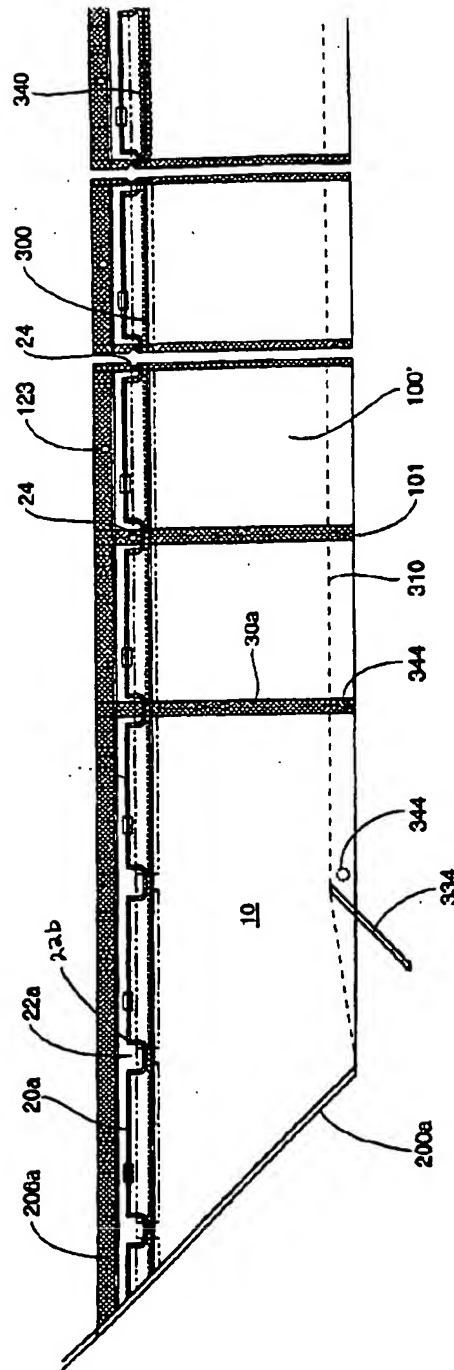


Fig. 48

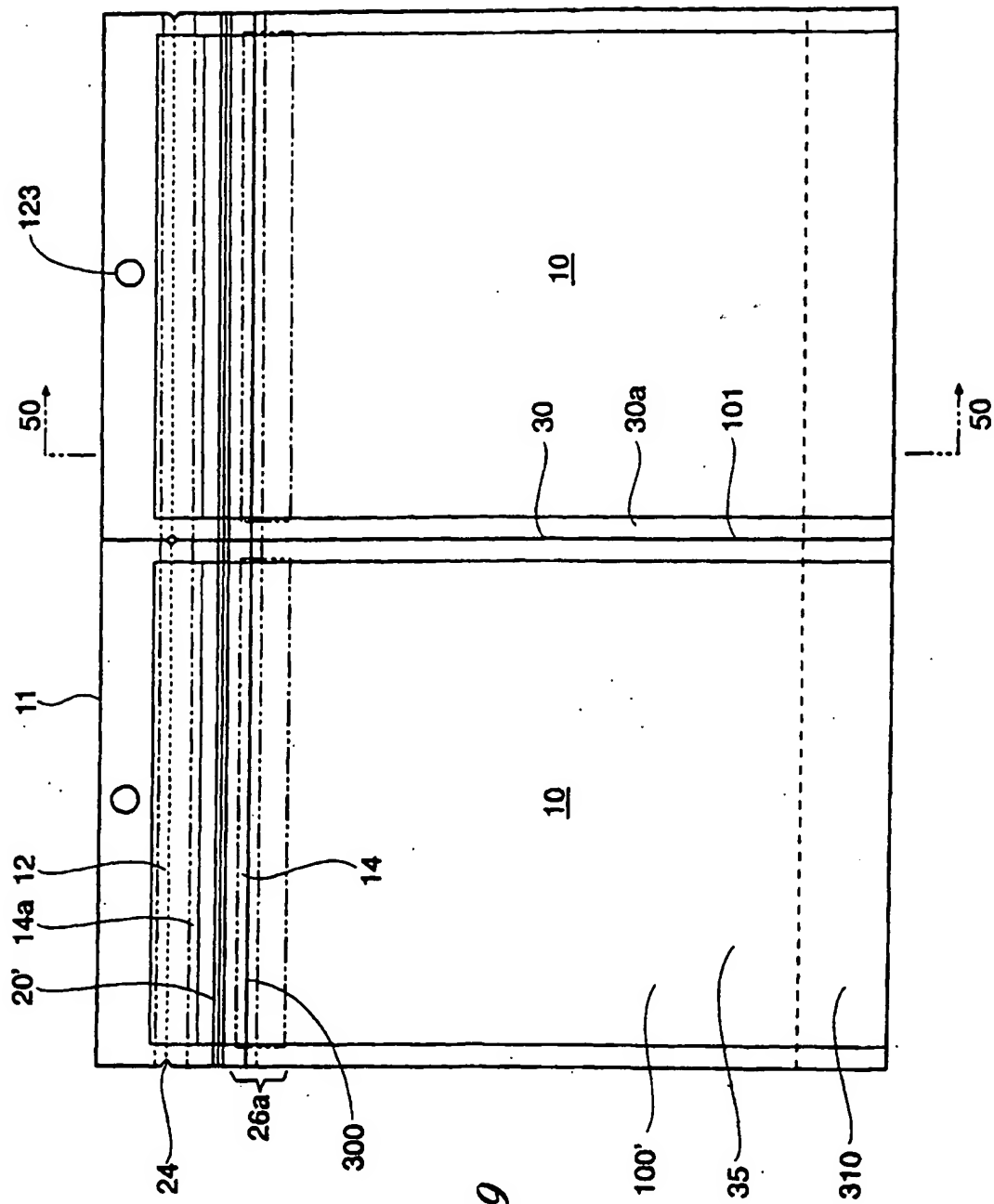


Fig. 49

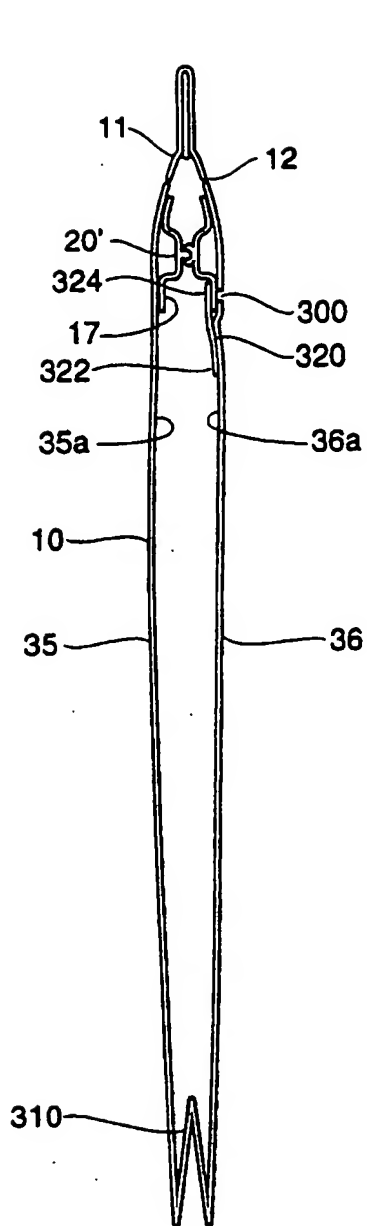


Fig. 50

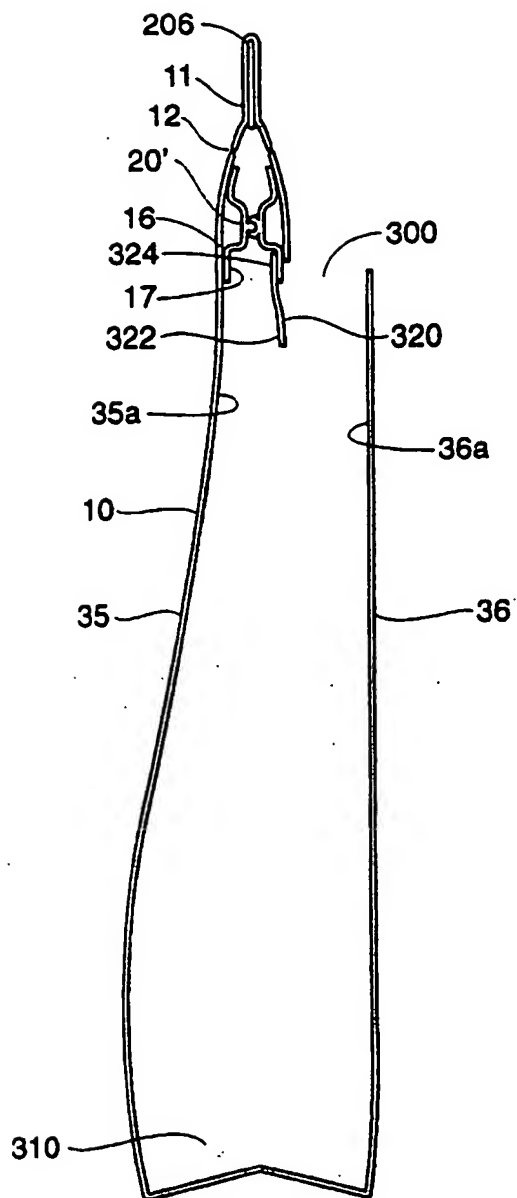


Fig. 51

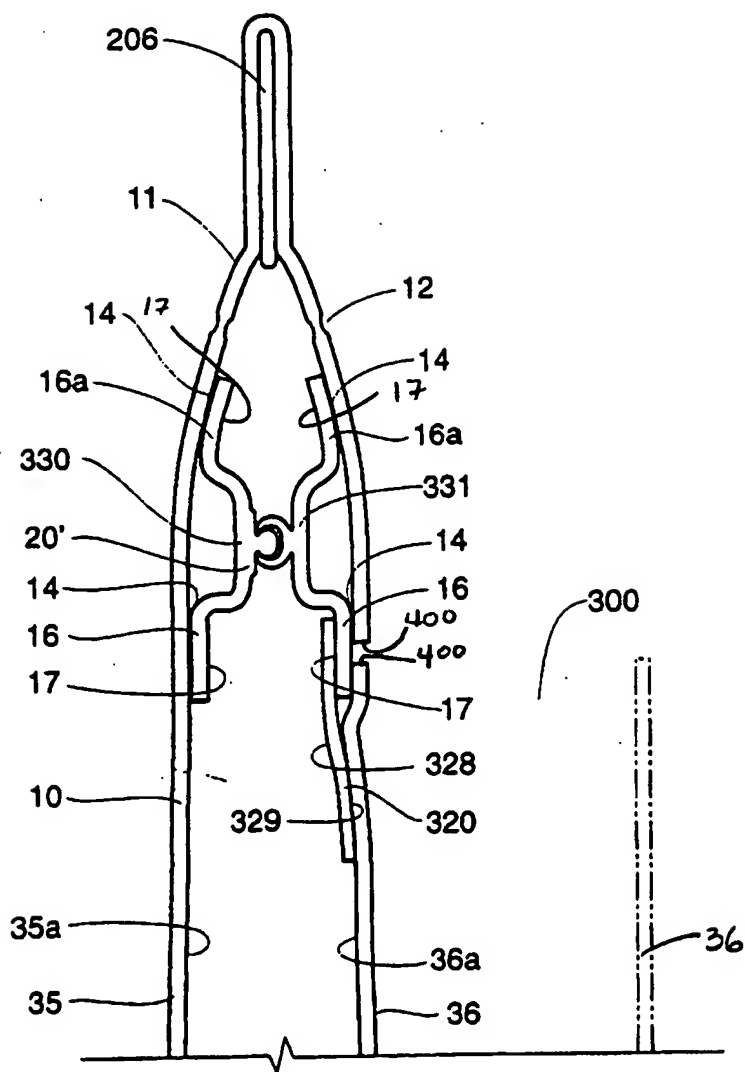
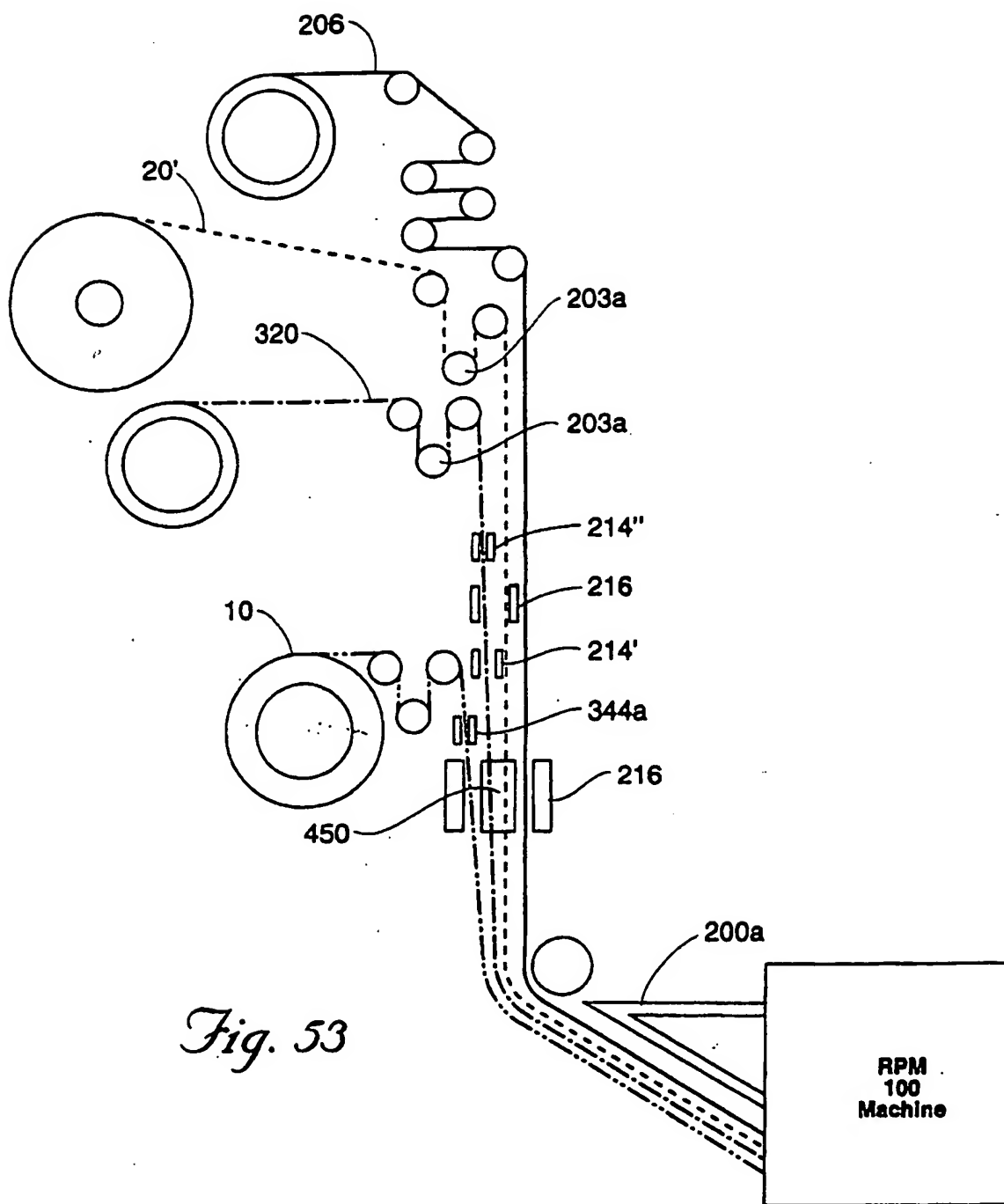


Fig. 52



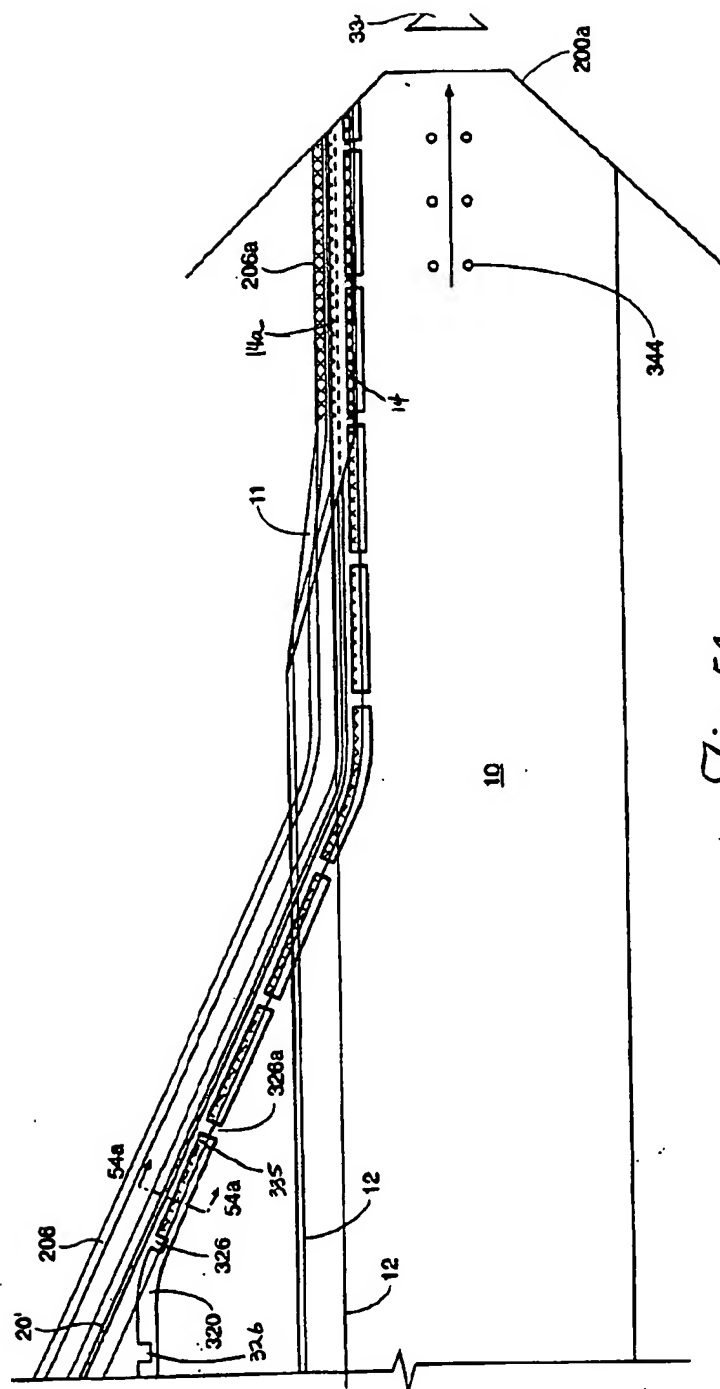
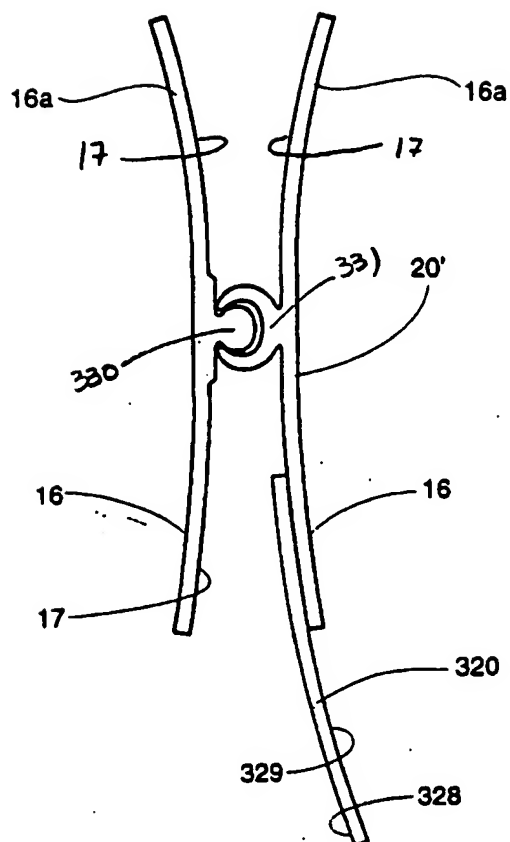


Fig. 54

*Fig. 54a*

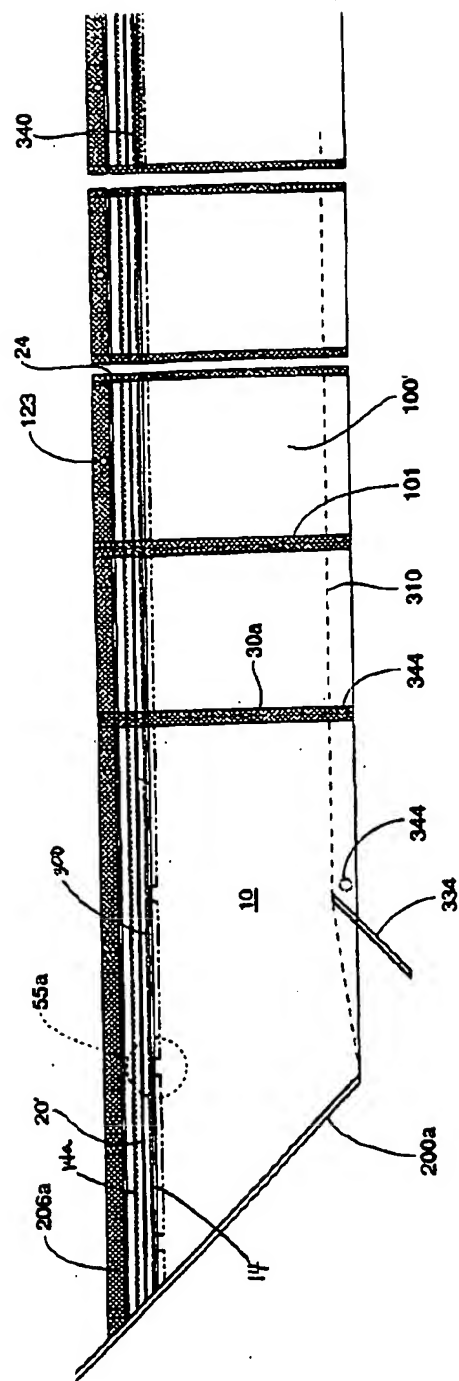
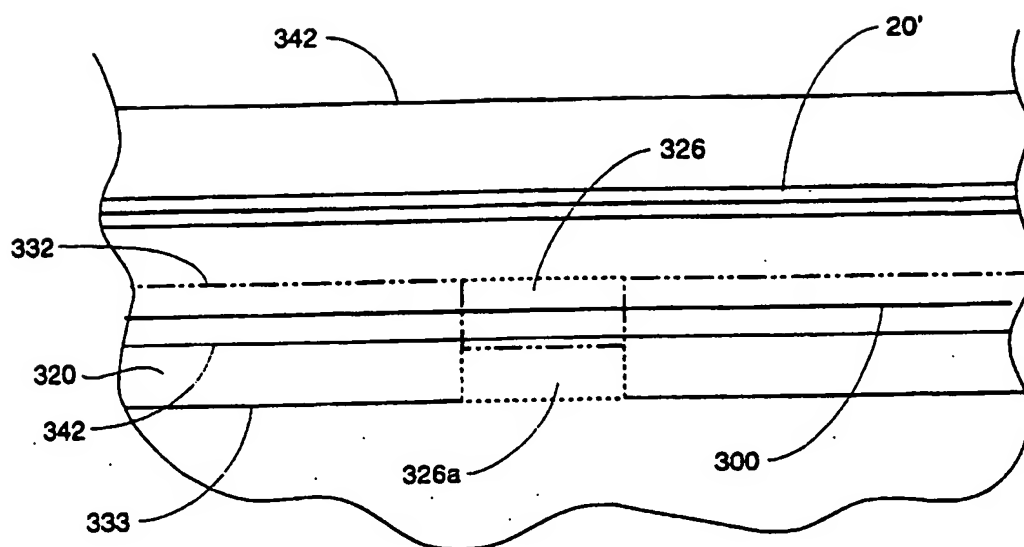


Fig. 55

*Fig. 55a*

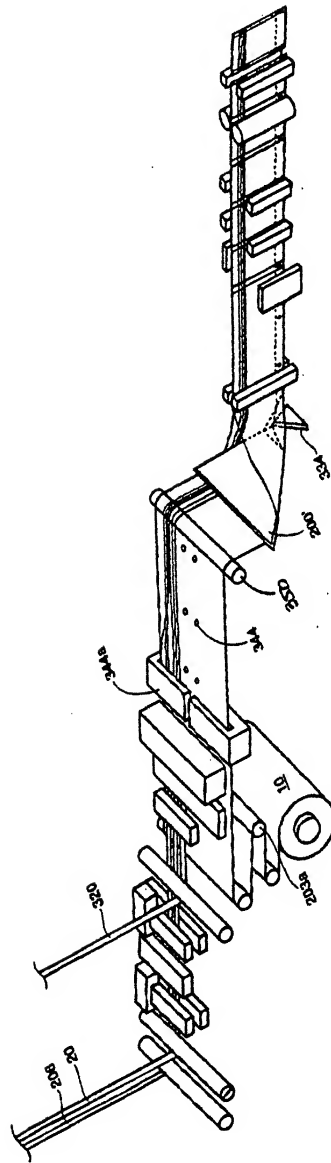


Fig. 56

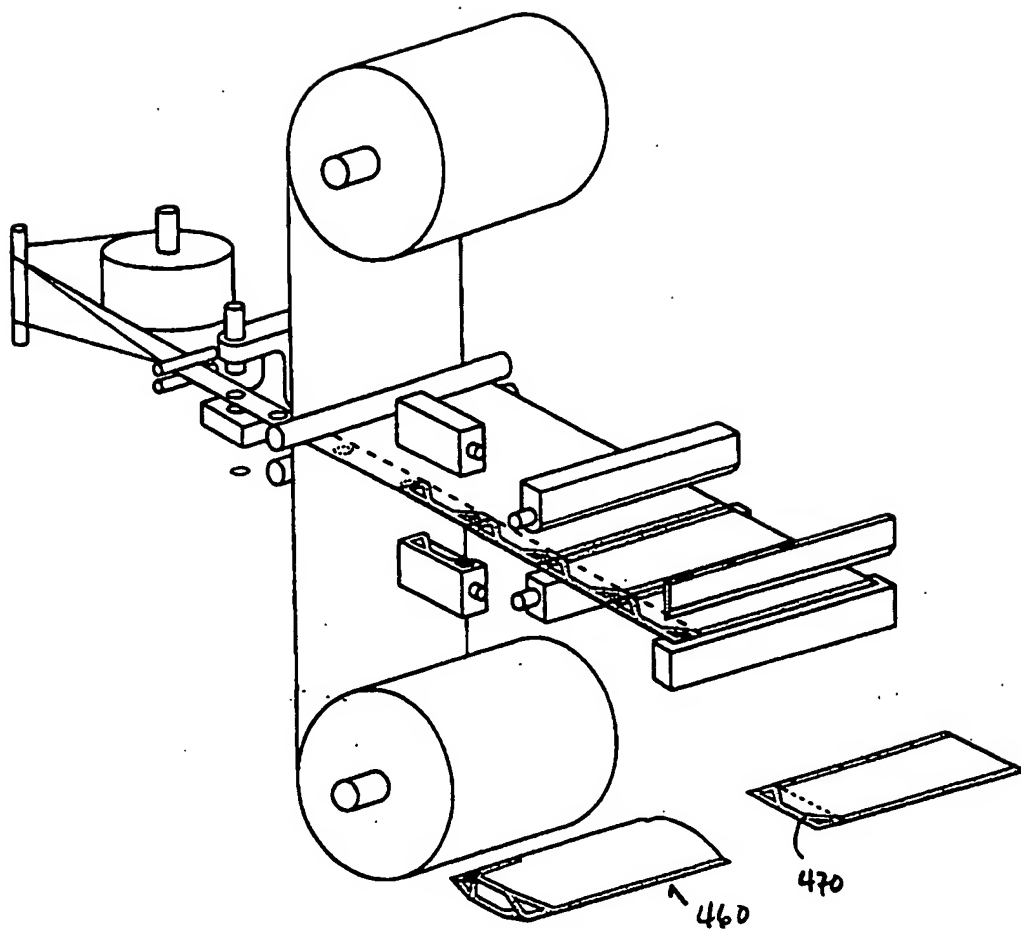


Fig. 57
PRIOR ART

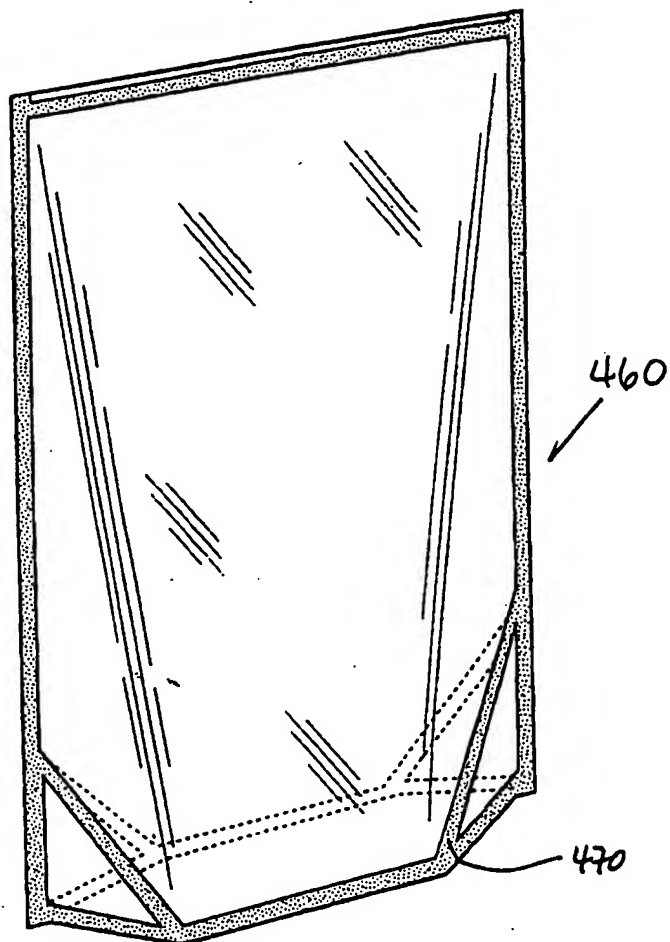


Fig. 58
PRIOR ART

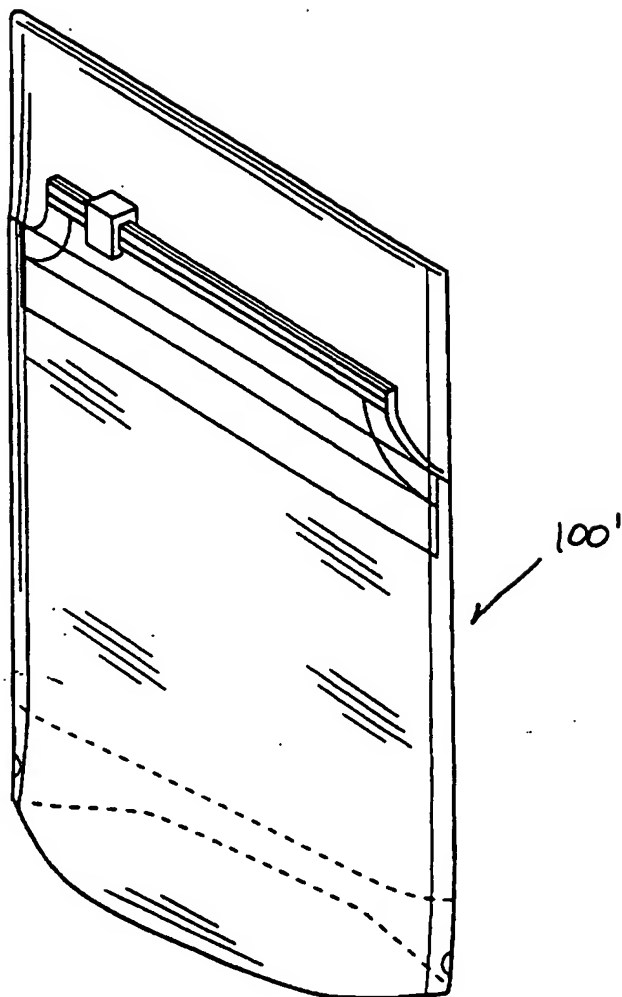


Fig. 59

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/25393

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B65D 33/00

US CL : 383/204

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 383/204,5,63,61,67,66,120,104,122; 53/133.4,133.3,139.2; 493/212,213; 426/392,410

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 3,780,781 A (URAMOTO) 25 DECEMBER 1973, see entire document.	1,2,6-9,11, 12,14-18, 29,37,40 3, 67, 73

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
*A	document defining the general state of the art which is not considered to be of particular relevance		
*E	earlier document published on or after the international filing date	*X	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*L	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*O	document referring to an oral disclosure, use, exhibition or other means		
*P	document published prior to the international filing date but later than the priority date claimed	*A	document member of the same patent family

Date of the actual completion of the international search

14 NOVEMBER 2000

Date of mailing of the international search report

08 JAN 2001

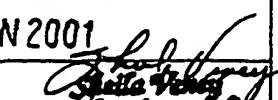
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Authorized officer

ROBIN A. HYLTON

Telephone No. (703) 308-1208


 Paralegal Specialist
 Technology Center 3700

INTERNATIONAL SEARCH REPORT

 International application No.
 PCT/US00/25393

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 5,023,122 A (<i>BOECKMANN ET AL.</i>) 11 JUNE 1991, see entire document.	1,2,6-9,14, 15,18,41,42, 46-49,54,55, 58,37,75,77, 81-84,89,90, 93,63,65,69, 71 ----- 3-5,11,12, 16,17,86,87, 91,92,51,52, 56,67,61,62, 43-45,67,73, 78-80,19,20, 59,60,94,95
Y	US 4,925,316 A (<i>VAN ERDEN ET AL.</i>) 15 MAY 1990, see entire document.	61,62,4,5, 43-45,138, 139,141-145, 147
Y	US 5,660,479 A (<i>MAY ET AL.</i>) 26 AUGUST 1997, see entire document.	19,20,37- 40,59,60,69, 71,72,74,94, 95,136,138, 139
X -- Y	US 5,529,394 A (<i>DAVOREN</i>) 25 JUNE 1996, see entire document.	140 ----- 117-126,12 8,129,131- 136,141-145,147